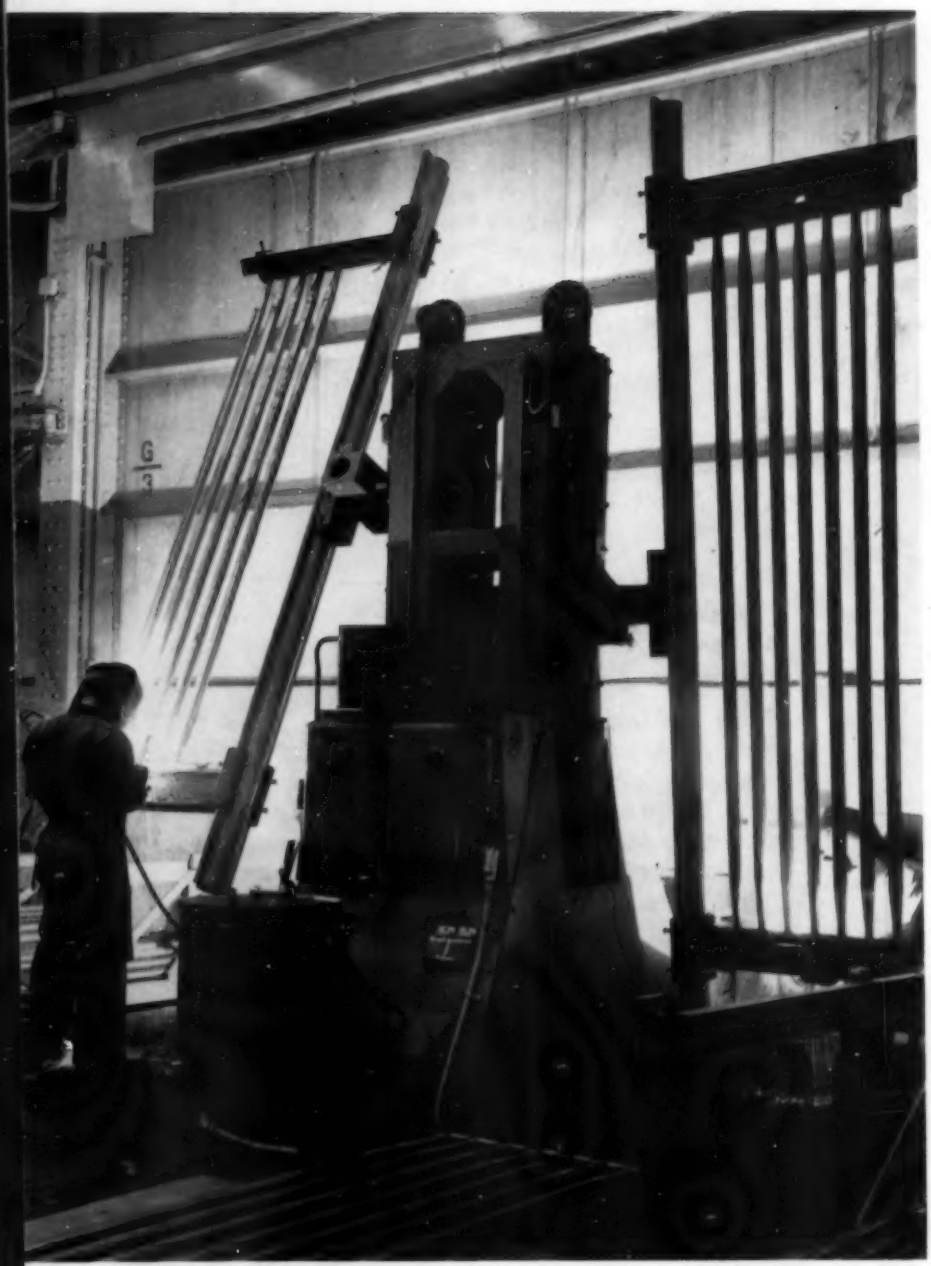
Industry and Power



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for engineers and executives responsible for

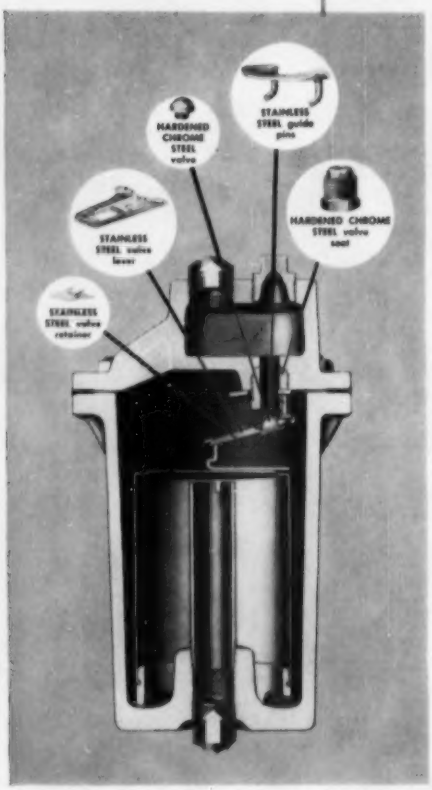
— engineered plant facilities

You will always get better results by putting a Steam Trap on each Steam Coil, Chest or Unit

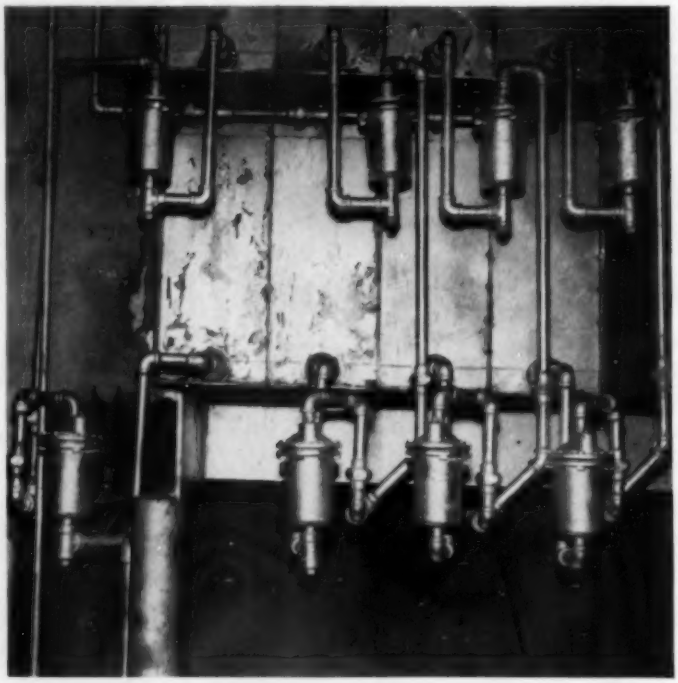
EXAMPLE

Dryer Temperatures at
Guelph Creamery, Guelph, Ontario.

WITH GROUP TRAPPING (5 steam traps for 10 coils)	**225°F**
WITH BLOW-THROUGH (no steam traps)	**250°F**
WITH ARMSTRONG UNIT TRAPPING (10 traps—one on each of 10 coils)	**309°F**


HARDENED CHROME STEEL valve
STAINLESS STEEL guide pins
STAINLESS STEEL valve lever
HARDENED CHROME STEEL valve seat
STAINLESS STEEL valve retainer

One of the big advantages of Armstrong traps is LOW MAINTENANCE. Mechanisms in low and medium pressure traps identical in design, workmanship and materials to those in 900°F, 900 psig traps.



● The example at the upper left is simply one of thousands that bear out the benefits of "Armstrong *Unit* Trapping".

When you analyze it, the reason is quite obvious. No two steam coils, chests, chambers or machines will condense steam at exactly the same rate under operating conditions. There is a greater pressure drop in the units that condense the fastest. Steam will backflow through a common drain line from a higher pressure unit to a lower pressure unit. This blocks off flow of air and retards condensate flow from the lower pressure unit. On the other hand, if you separate each unit with its own trap, that can't happen.

You will *always* get higher temperatures and lower production costs with unit trapping. Ask your Armstrong Representative about it, or write:

ARMSTRONG MACHINE WORKS
820 Maple Street, Three Rivers, Michigan

FREE—STEAM TRAP BOOK

If you don't have a copy of the 44-page Armstrong Steam Trap Book, we'll be glad to send you one. No obligation.

ARMSTRONG STEAM TRAPS

Circle 500 on Reply Card for more data

EASIER ON CARS with minimum noise level . . . thanks to exclusive low-frequency vibration. The Link-Belt Car Shaker helps hopper cars empty themselves. Even hard-packed loads come "broom clean" in a matter of minutes. Especially good for damp, sticky materials. Write for Book 2345.

BOTTOMS UP . . . empties 90-ton car every 60 seconds or less (including return to upright position) by simply turning car upside down. Simple, automatic, foolproof. Takes all open-type cars—any length, width or height . . . up to 90-ton or 120-ton capacity. Book 2048-A has complete data.

Railroad cars come clean . . . in as little as 60 seconds or less!

For fast, safe, push-button car unloading . . . at substantial savings — choose Link-Belt equipment

IF you empty a few gondola cars a day—or several thousand a week, Link-Belt makes the right railroad car unloader for your particular requirements. Only Link-Belt builds both types—the automatic Rotary Car Dumper for large users . . . the low-frequency Car Shaker for smaller operations.

Both are precision engineered to reduce unloading hazards, minimize injury possibilities, cut costly demurrage charges.

Yes, if your operations require rapid railroad car unloading of any bulk material, it will pay you to call your nearest Link-Belt representative. He'll give you an unbiased recommendation for the right type of equipment for your needs.

LINK-BELT

CAR SHAKERS and ROTARY DUMPERS

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...for Process and Boiler Feed Water Applications

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- **HEATERS AND DEAERATORS**
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- **WATER SOFTENING EQUIPMENT**
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  Flash Tanks • Sample Coolers • Heat Exchangers

STEAM SPECIALTIES AND DRAINAGE EQUIPMENT

- **MULTIPORT RELIEF VALVES**
  Positive Action for Pressure and Vacuum Relief • Atmospheric Relief Valves • Foot Valves • Back Pressure Valves Condenser Relief Valves • Water Check Valves • Flow Valves
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- **SEPARATORS AND PURIFIERS**
  Steam Purifiers • Steam & Oil Separators • Receiver Separators
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  Internal Pilot Actuated Regulating Valves • Float Boxes
- **MISCELLANEOUS**
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A complete complement of water conditioning equipment, manufactured by a single company . . . under a single responsibility.

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Industry and Power

Published by Industry and Power Publications

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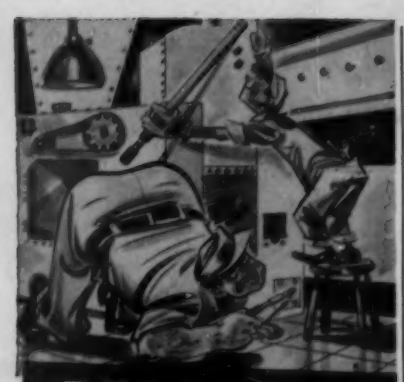

Midgets or Giants?

You'll Find Both in PROTO's EXPANDED Line of Torquers

Four new plain head models of the amazing Torquer have been added — two "midgets" (¼" and ⅜" drives) and two ¾" drive "giants." Both midget sizes, with their capacity of 5 to 165 inch-pounds, are ideal for torquing of aircraft parts, instruments, electronic equipment, automatic transmissions, etc. The "giants" are musts for aircraft, automotive, locomotive, diesel engine and construction equipment manufacture and maintenance. Capacities of the 16 models now offered range from 5 to 4800 inch-pounds and six sizes have ratcheting heads for increased versatility. Check the many advantages of these advanced tools, try them at your PROTO dealer's, and then buy the models you need. Send 10¢ for 68-page catalog showing the entire PROTO line to

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Canadian Factory—London, Ont.
Circle 503 on Reply Card for more data

acorns

. . . recently announced . . . worth watching

Canned Pump

● The Atomic Energy Commission announced details of a canned electric motor driven pump for use in the USS Nautilus. The pump, literally canned to make it leak-proof, was developed for the AEC by Westinghouse Electric Corp. and is also expected to find general industrial applications.

Tape Control

● Telegraphing spare parts all over the world is one of the interesting possibilities engineers foresee for tape-controlled automatic machine tools.

Employing the principle of the player piano roll—holes punched on a tape—lathes and other machine tools can be made to follow a pattern to reproduce parts automatically and in large quantities. If the pattern information can be put on teletype tape, it can be telegraphed to distant places to control machine tools on the spot.

Saving Power

● A new device called a Transmission Penalty Factor Computer promises to help utilities determine more exactly which of a number of generating plants should be used to produce and transmit an increased load at the least possible cost.

The computer takes into account the amount of power lost in transmission over power lines. These losses vary with both amount of power and distance of transmission, and estimating them for a complex system requires lengthy and difficult calculations. By helping the load dispatcher recognize the most economical way of supplying power to the consumer, an estimated annual savings of over $100,000 can be made with the computer.

Coating Systems

● Sixty different coating systems, applied on rusty steel panels, were tested in a chemical plant and scored for appearance, adhesion, creep corrosion, and edge protection. Panels were suspended outside in a 7 percent sulfuric acid mist at 130 F developed by acid flowing over a weir. Temperatures ranged from 20 F to 95 F.

The data shows quite conclusively that both primer and finish selection are important when painting rusty steel in corrosive atmospheres. The vinyls as a class were good, equalled or excelled only by neoprene, some methacrylates, and a special unplasticized, flexible furan coating.

Electrified Liquids

● A new metal powder—a blend of metals processed with muriatic acid—permits the identification, evaluation, and comparison of any liquid as dc and ac voltage and current indications on electrical meters. This new product can electrify any liquid or moist material.

The metal is endowed with three well-defined properties: 1. in powdered form, it remains inert indefinitely until placed in a liquid where it undergoes electrical imbalance manifested as a change in voltage and current for each liquid type or quality, 2. permits noncorrosive fluxless soldering or welding of aluminum or zinc, and 3. acts as a dry bearing metal able to function without or with lubrication or to make any encompassing liquid act as a lubricant.

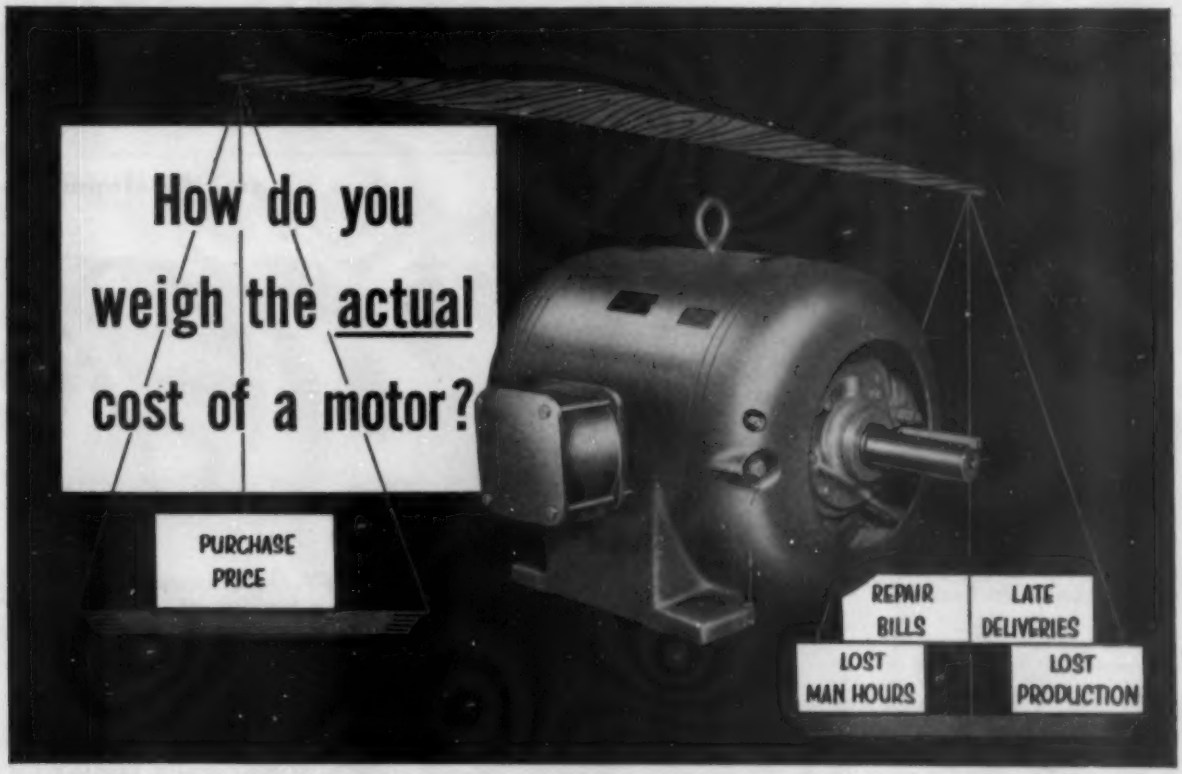
Improved Plastic

● A melamine-polyester plastic — intended for such electrical applications as transformers, television and radar insulation, circuit breakers, switch bases, and supports for sliding contacts . . . in fact, wherever good electrical and arc resisting properties are required — has recently been introduced.

Engine Maintenance

● An improved system of engine conditioning, developed first for B-29 planes operating in the South Pacific, has been perfected by the Air Force.

Applicable to all four-stroke cycle engines this system shifts emphasis from corrective maintenance (with its attendant danger and delay) to preventive maintenance, and spots engine malfunctioning before serious trouble can develop. "Engine conditioning" treats the engine as a complete unit, checking all phases of its operation at the same time and in an organized pattern. This system of checks and tests can be applied, with variations, to all engines.



Keep costs down...choose Wagner® Motors

The selection of the right motor for every specific industrial application is all important. Due consideration must be given to motor type, rating, slip, torque values, and other operating characteristics.

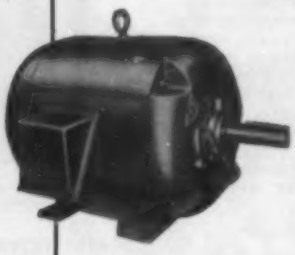
But, because the ultimate cost is the actual cost of a motor . . . alert buyers look beyond such specifications. They look for other factors, such as cool operation, with consequent longer insulation life . . . and they consider the *time-tested proven dependability* of the brand of motor they specify. They know that it's costly to take chances with motor drives.

Wagner Motors have been proving their reliability for more than sixty years. Many thousands of users throughout industry have found them a lasting investment in continuous troublefree performance.

The wide range of types and sizes in Wagner's complete line permits the selection of a standard motor for almost any need. Bulletin MU-185 gives full information.

Your nearby Wagner engineer will be glad to help you select the *right* motors for your next application. Call the nearest of our 32 branch offices, or write us.

Open type polyphase squirrel-cage motor for general purpose applications ... ½ to 400 hp.



Totally enclosed, fan-cooled motor...explosion-proof or standard types...steel or cast-iron frame...1 to 250 hp.

Wagner Electric Corporation EST. 1891

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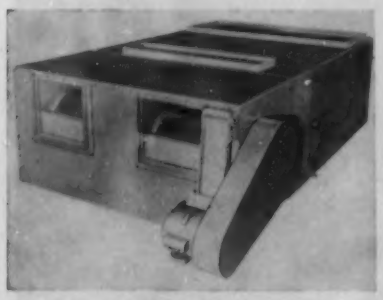
new equipment

. . . new developments



Heating-ventilating units offer installation flexibility

G10 Herman Nelson heating-ventilating units, designed by American Air Filter Co., Inc., have capacities ranging from 1200 to 15,000 cfm. They can provide heating, ventilation, filtering, humidifying, or any combination of these functions, and are available for installation on floors, ceiling, or walls. Bulletin gives full capacity, rating, and installation data.

Belt covers full width of drive power

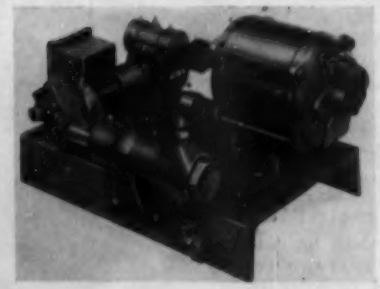
G11 Poly-V-Belt, a single, endless rubber belt with a series of paralled V ribs molded lengthwise around the inside circumference and an uninterrupted, high-strength member of synthetic cords across its entire width is being introduced by Manhattan Rubber Div. of Raybestos-Manhattan, Inc. Sheave grooves are designed to mate precisely with the belt ribs, and since the belt covers the full width of the drive member, the load is distributed equally over the driving surface.

Diesel engine line features greater output

G12 P & H Diesel Engine Div. of Harnischfeger Corp. is now in production with an improved line of 1800 rpm 2-cycle diesel engines with ratings of 58 to 225 hp. Redesigned cylinder assembly is said to provide improved efficiency and far longer service. Lighter weight, the six-cylinder model weighs 1800 lb, or 7.06 lb hp.

Lastest designs and materials incorporated in chlorinator

G13 The A-701 chlorinator features such improvements as the dual orifice meter which automatically, or by the flip of a switch, allows feed ranges up to 100 to 1; corrosion resistant materials wherever good structural design permits; linear scale reading of chlorine flow rate; and automatic electric, hydraulic, air, or vacuum control. Wallace & Tiernan, Inc.



Motor driven pump for proportional feed systems

G14 Motor-driven controlled volume pumps for use in proportional feed systems are announced by Milton Roy Co. Pumps have capacities from one pint to 1350 gal per hr, against discharge pressures up to 50,000 lb per sq in. Literature available.

Unit features compact, worm type speed reducer

G15 Reuland Electric Co. has developed a unit which features fluid-cushioned starting in conjunction with a compact, worm type speed reducer. This compactness, plus increased mounting versatility (16 different positions) make these reducers well suited to installations in tight, hard to get at places. Speed reductions from 24 through 140 rpm are offered.

Midget cleaner heads solve tube maintenance problems

G16 The Airetool Mfg. Co. announces a full line of midget cleaner heads and motors flexible, and powerful enough to completely eliminate small diameter tube maintenance difficulties. When used in combination with universal joints or flexible shafts, they are said to be very effective in cleaning bent tubes where the radius of curvature is short.

Dust and corrosion no problem for heavy-duty thermostat

G17 The heavy-duty thermostat developed by Minneapolis-Honeywell Regulator Co. is designed for accurate control of temperatures in areas where dust, corrosion, and humidity are a problem. It will control gas, oil, or stoker-fired heating plants. Control range is between 35 and 100 F.

NOTE—Each new product item has a key number for your convenience in asking for additional, detailed information. Circle this number on Reply Card, pages 36/37 & 92/93.

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■ Recently, one of our visitors referred to this room as the Betz "Laboratory of Water Conditioning Experience". Actually, he wasn't far wrong.

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BETZ

CONSULTANTS ON INDUSTRIAL WATER PROBLEMS

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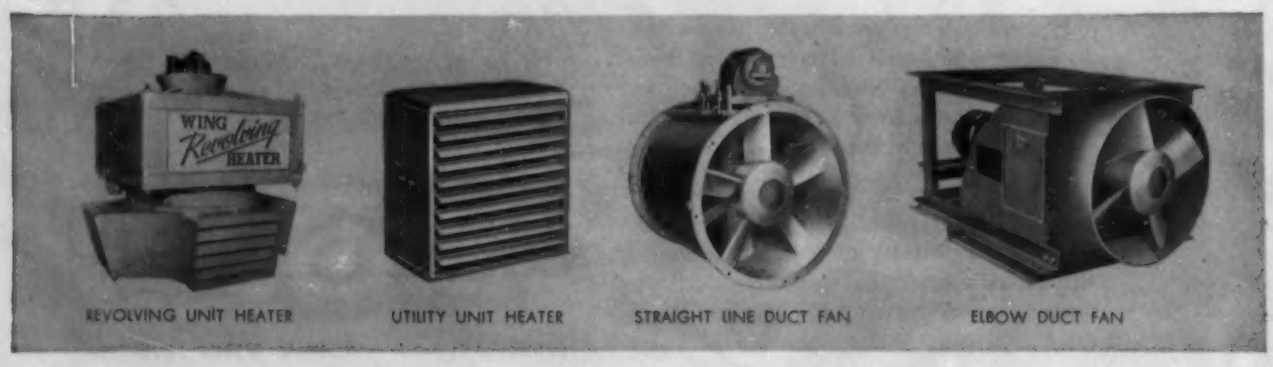
In 1879, it was the new "Wing's Disc Fan"

It was 75 years ago that L. J. Wing, an ingenious Yankee who had come to New York with some ideas about mechanical devices, formed the company which later became the L. J. Wing Mfg. Co., for the purpose of manufacturing and selling "Wing's Disc Fan" which, according to his catalog, would "move more air than any other Fan made for heating, ventilation, drying, etc., as competitive trials have shown". Today, Wing products for ventilation, heating and combustion are known for their efficiency and dependability in all parts of the world. The company Mr. Wing founded has kept his ideals of originality and excellence constantly before them.



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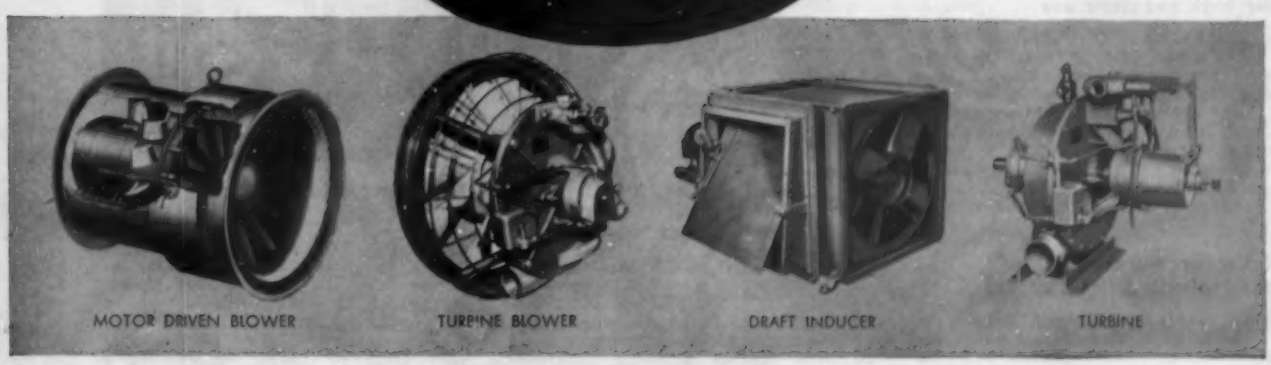
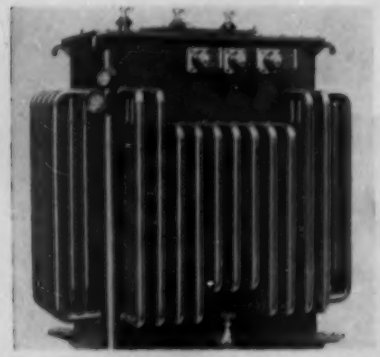


Circle 506 on Reply Card for more data

new equipment

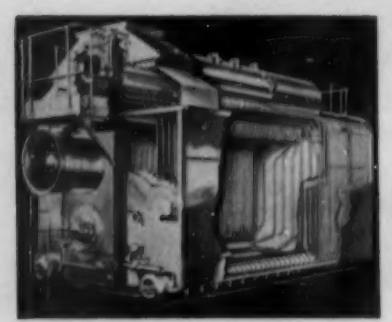
—Starts on page 8

A switching action is provided so it can also be used to regulate building ventilating systems.



Transformers have short-circuit and high-impulse strength

G18 Line Material Co. announces the Uni-Wound 3-phase distribution transformers in sizes 112½, 150, 225, 300, and 500 kva at standard distribution voltages through 14,400 v. These units are said to provide the same advantages offered by the present single-phase Round-Wound transformers such as light weight, short-circuit strength, and high impulse strength.

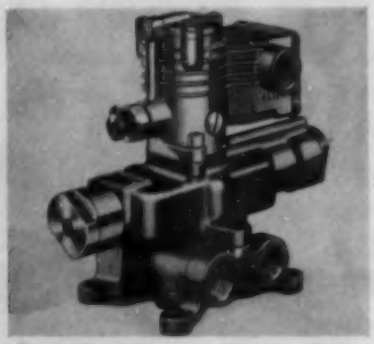


Packaged steam generators for high pressure use

G19 Packaged type MH water tube steam generators can be fitted with components to meet a broad range of needs for power, process, or space heating according to the manufacturer Union Iron Works. Capacities of standard units range from 10,000 to 40,000 lb of steam per hr and pressure of 250 psi. Literature is available.

Reflector mercury lamp has increased light output

G20 Forty-two percent increase in light output of General Electric's 400-w color-improved reflector mercury lamp (H400-RC1) is announced by the company's Lamp Div. The improvement steps up the lamp's light output from 12,300 to 17,500 lumens.



Valves designed to meet J.I.C. standards

G21 Valvair Corporation has expanded its line of Speed King solenoid pilot operated control valves to meet the standards set by J.I.C. The base is cast bronze, and the pilot valve a zinc base alloy casting. Pressure range is from 35 to 200 psi for air and low pressure hydraulics. Two, 3, 4 and 4-way-5-port models with pipe sizes from ¼ through 1 in. are offered.

TO REQUEST ADDITIONAL DATA

Circle "key" numbers on Reply Card between pages 36/37 & 92/93. Your requests will be handled promptly.

Plastic found effective as emergency packing

G22 Teflon plastic packing 403 is serviceable from -150 to 550 F and can be used on all packing applications that require the use of Teflon. According to the Mechanical Packing Div. of Flexrock Co., this product is effective as an emergency packing that can be readily adapted for use wherever time or other conditions make it impracticable to have preformed packing rings made to order.

Compact shell and tube chiller

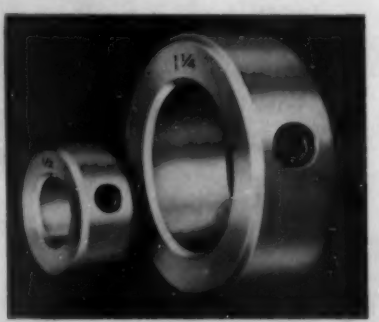
G23 Heat-X-Changer Co., is introducing a new line of inner-fin chillers for use in chilled water air-conditioning systems and other liquid cooling applications. Incorporation of patented Heat-X inner-fin construction is said to make this the most compact shell and tube chiller on the market. A selection of water baffle spacings is available to meet a wide range of water pressure drop requirements, and rock cork insulation is available on all sizes. An illustrated bulletin contains specifications.

Sub-base provides permanent plumbing for valve

G24 A flexible arrangement which provides permanent plumbing for the ½ in. Barksdale manifold 4-way valve makes this sub-base ideal for a production line installation where maintenance down time is costly. Valve replacement can be made quickly by simply removing four bolts; the piping remains undisturbed. Barksdale Valves.

Pillow blocks for light duty applications

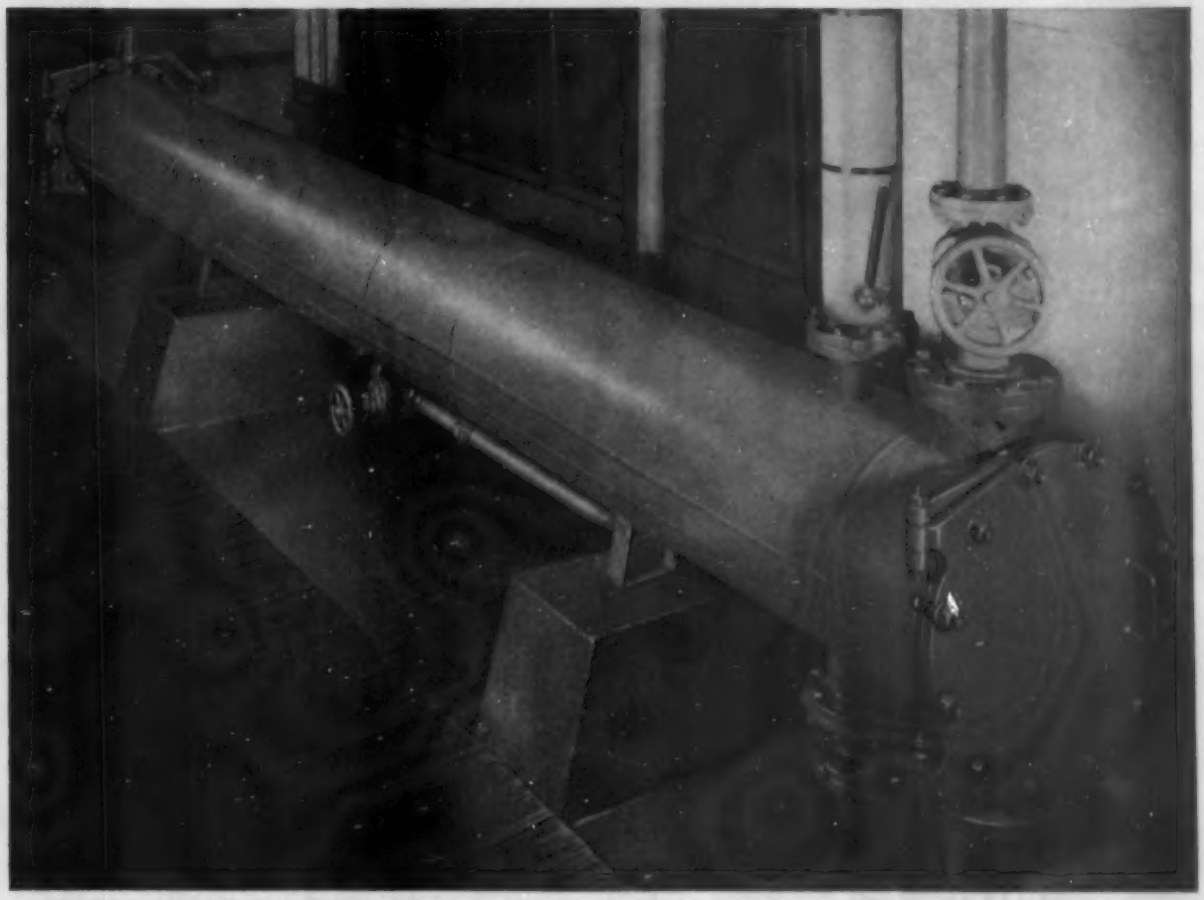
G25 Low-cost ball bearing pillow blocks with pressed steel housings, designed for applications where speeds are relatively low and loads are light, are announced by Link-Belt Co. Known as Series JPS-200, they are available for shafts from ⅝ to 1¼ in. in diameter, and are easily installed by slipping the inner ring onto a shaft and locking it into position. Slotted bolt holes permit easy lateral adjustment. Folder No. 2517 includes load ratings and dimensions of pillow blocks.



Solid and stainless steel shaft collars available

G26 Precision machined solid steel and stainless steel collars, introduced by Rockwood Pulley Manufacturing Co., are all cadmium plated with a zinc alloy to permit welding when necessary. Collars are available from stock in standard specifications

Banner Yarn Dyeing Corp.



25,000 gal/hr of city water passes through this p-k reclaimer, is heated from 46° to 105°, free of cost.

saves 25% fuel costs with a p-k waste water heat reclaimer

Passing hot spent dye liquors through a **p-k** waste water heat reclaimer saves 25% of fuel costs, reports Banner Yarn Dyeing Corp., Brooklyn.

At Banner Yarn, for example, city water comes into the plant at 46° or lower. Once through the heat reclaimer, the incoming cold water temperature is raised, without cost, to approximately 105°. The **p-k** reclaimer shown has been in continuous operation for over seven years and requires a one hour cleaning job only 3 or 4 times a year. During average operation, Banner's oil heating facilities use 4000 gallons every 24 hours, 25% less than before installing the **p-k** waste water heat reclaimer.

Such savings are *usual* for owners of **p-k** heat reclaimers. Passing waste hot water through **p-k** reclaimers costs nothing after units are installed, pays off every day thereafter.

p-k heat reclaimers are available in many standard sizes and types, each specifically designed to do the best job for you. Write for fact-packed brochure that gives all details, **p-k** No. 310.

the **Patterson-Kelley Co.,** *inc.*

1170 Burson Street, East Stroudsburg, Penn.

1910

101 Park Avenue, New York 17 • Railway Exchange Building, Chicago 4 • 1700 Walnut Street, Philadelphia 3 • 96-A Huntington Avenue, Boston 16 • and other principal cities

Circle 507 on Reply Card for more data

Now!...

An INTERRUPTING RATING in EXCESS of 100,000 AMPERES *for every set of fuse clips in your plant* . . . simply by installing FUSETRON *dual-element* FUSES

The Biggest Electrical Protection NEWS Since BUSS invented the FUSETRON Dual-Element FUSE

FUSETRON is a trademark of the Bussmann Mfg. Co., Division of McGraw Electric Co.

In 1947 tests made by the Electrical Testing Laboratories of New York, showed that on a circuit set to deliver 50,000 amperes, FUSETRON fuses in all tests cleared the circuit safely.

50,000 amp. Interrupting Capacity in 1947
becomes
100,000 amp. Interrupting Capacity Today

After years of intensive development work on FUSETRON fuses new tests were conducted under conditions that simulated the most severe field conditions and these tests were witnessed and verified by the Electrical Testing Laboratories of New York.

On circuits set to deliver in excess of 100,000 amperes, 30 to 600 ampere, 250 and 600 volt FUSETRON dual-element Fuses on each and every test cleared the circuit without belching flame or venting hot gases and with comparatively little noise.

Oscillograms of these tests interpreted by the Electrical Testing Laboratories, showed that the total available amperes including the direct current component, reached values as great as 165,000 peak amperes on 240 volt tests and as high as 212,000 peak amperes on the 535 volt tests.

This indicates that an interrupting rating of 100,000 amperes for FUSETRON dual-element fuses is a conservative one.

No interference with time-lag

In the development work to increase interrupting capacity in FUSETRON fuses it was kept in mind that the time-current characteristic must be maintained. Time-lag is of utmost importance to give proper motor and electrical protection and to eliminate needless blowing of fuses.

Remarkable results have been achieved. Interrupting capacity has been greatly increased while the time-current characteristic of FUSETRON fuses has in no way been disturbed.

Play Safe – install Fusetron Fuses throughout the entire electrical system!

Think!...

ALL THIS ADDED SAFETY *without changing a panelboard or switch... plus* 10 Point Protection of FUSETRON *dual-element* FUSES!

Maximum Safety

With FUSETRON Fuses there is no cascading of interrupting rating — no places where an excessive fault current might cause serious damage. Every FUSETRON fuse has an interrupting rating in excess of 100,000 amperes.

You don't have to worry about selecting chosen spots in which to *pay extra* for "safe" equipment. Wherever a FUSETRON fuse is installed you have safety as sure and dependable as you can buy — no matter what you pay.

No Maintenance Costs

When FUSETRON fuses have once been installed properly you can forget about them. They need no periodic inspections to see if they will operate safely.

Dust, fumes, corrosion or age cannot prevent a FUSETRON fuse from opening safely. There are no hinges, pivots or contacts to stick or slow down the operation of the fuse on short-circuit.

With FUSETRON fuses — you get safety — without one cent spent for inspection or maintenance costs.

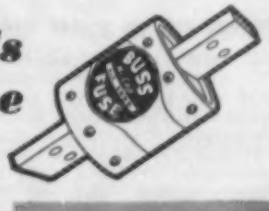
No Recalibration Costs

When a FUSETRON fuse does blow, there is no recalibration needed. As quickly as the fault in the circuit is corrected, you slip in a new fuse that has been CALIBRATED AT THE FACTORY BY ENGINEERS— a fuse that is as safe and dependable as the one that blew.

PLUS 10 POINT Protection with FUSETRON dual-element FUSES

1 Protect against short-circuits. **2** Protect against needless blows caused by harmless overloads. **3** Protect against needless blows caused by excessive heating — lesser resistance results in cooler operation. **4** Provide thermal protection — for panels and switches against damage from heating due to poor contact. **5** Protect motors against burnout from overloading. **6** Protect motors against burnout due to single phasing. **7** Give DOUBLE burnout protection to large motors — without extra cost. **8** Make protection of small motors simple and inexpensive. **9** Protect against waste of space and money — permit use of proper size switches and panels. **10** Protect coils, transformers and solenoids against burnout.

for SAFE PROTECTION on loads above 600 and up to 5000 Ampere install BUSS Hi-Cap FUSES



Tests have shown that BUSS Hi-Cap fuses have unlimited interrupting capacity on circuits of 600 volts or less.

They are designed to give protection against dangerous overloads as well as high fault currents — yet their speed of operation on heavy shorts limits currents to safe values. This minimizes damage to equipment and cuts down dangerous stresses on transformers.

When coordinated properly with FUSETRON dual-element fuses they will not open ahead of the fuses nearest to the fault. Thus trouble is isolated to the part of the circuit in which the fault occurs.

Added SAFETY on Old Installations

On installations where the increase in the capacity of the circuit has outgrown the interrupting rating of the circuit breakers, BUSS Hi-Cap fuses offer a safe and relatively inexpensive way to protect inadequate breakers against rupture in event of a bad fault.

ACTION THAT SAVES YOU MONEY

By passing the word along that all purchase and stock records should call for FUSETRON fuses on loads up to 600 amps—and BUSS Hi-Cap fuses on loads above that — you get action that begets money saving.

For blowing time charts or more information on FUSETRON Fuses and BUSS Hi-Cap Fuses write for Bulletins FIS and HCS.

Bussmann Mfg. Co., University at Jefferson, St. Louis 7, Mo. Division McGraw Electric Company

Circle 508 on Reply Card for more data

new equipment

—Starts on page 8

with four sizes from ¼ to 3 in., as well as special made to order.

Casters lock for safety

G27 Precision Equipment Co. announces a ladder which may be rolled easily to the desired position. Casters automatically lock when the ladder is stepped on. Ladders are made with two, three, four, and six steps.

Refrigerant hose cuts diffusion

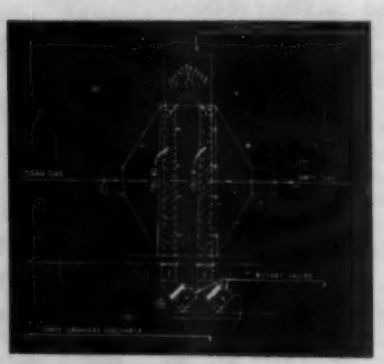
G28 Development of two refrigeration service hoses designed for the lowest possible diffusion of refrigerants is announced by Electric Hose & Rubber Co. They feature freedom from contamination of the refrigeration system, resistance to oil, and excellent serviceability over a range of -40 to 250 F. Style 3541 is designed for use with Freon 12; Style 3542, for use with Freon 22.

Pipe markers unaffected by extreme temperatures

G30 All-Temperature Pipe Markers will stick to pipes at continuous temperatures from -300 to 300 F—intermittent temperatures to 450 F, according to the W. H. Brady Co. The markers stick without moistening to bare or insulated pipe and conform to ASA standard A-13.

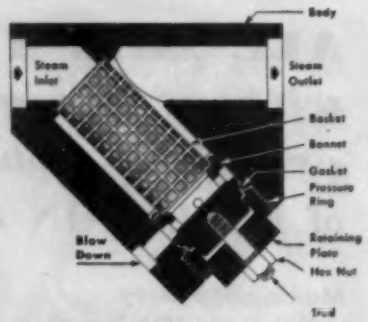
TO REQUEST ADDITIONAL DATA

Circle "key" numbers on Reply Card between pages 36/37 & 92/93. Your requests will be handled promptly.



Filter is adaptable to new or existing plants

G31 In the Dorfan Impingo Filter the control of fumes, dust, and smoke is accomplished by a moving granule principle, rather than by conventional cloth-type bags or water sprays. Introduced by Mechanical Industries, Inc., this type of unit is adaptable to the air and fume systems of new or existing plants. It also can be used for by-product recovery.



Strainer features forged body and pressure seal joint

G32 Strainer 994-HP introduced by Schutte and Koerting Co. incorporates, in a forged steel or forged alloy body, new "pressure seal" bonnet construction. For steam and boiler feed pressures above 900 lb, the strainer has been designed so that no piping need be broken when removing the cover and strainer basket from the body for maintenance.

Oil resistant hose withstands sharp bends

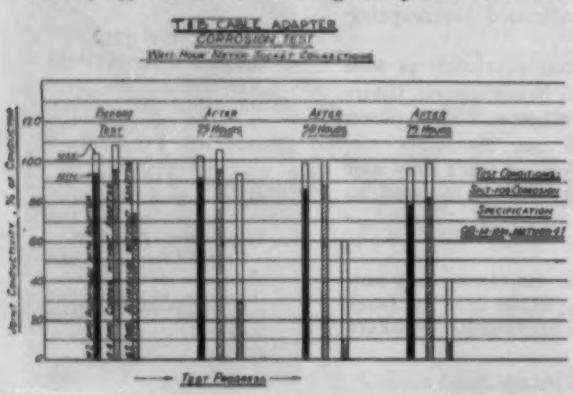
G33 Light-weight hose that withstands sharp bends without kinking and will not collapse under the partial vacuum of rapid discharge has been developed by Hewitt-Robins, Inc. for use in the unloading of gasoline, industrial lubricants, and drawing and cutting oils from delivery trucks.

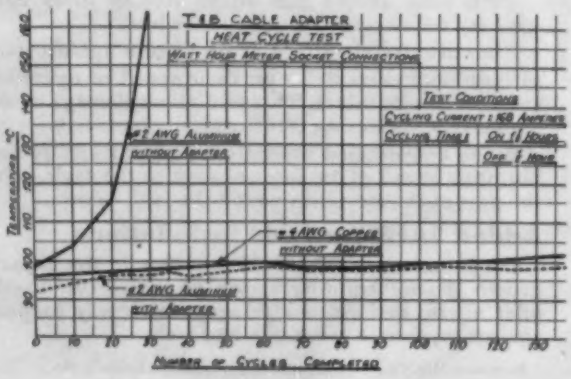
Adapter allows wider use of aluminum cable

G29 Interchangeable use of aluminum and copper electrical conductors in switch and control equipment is said to be possible with use of a new connecting device developed by The Thomas & Betts Co. Called an aluminum cable adapter, it is made in straight and right angle types for #4 and 2 stranded aluminum cable and is designed to combine good electrical conductivity with springiness.

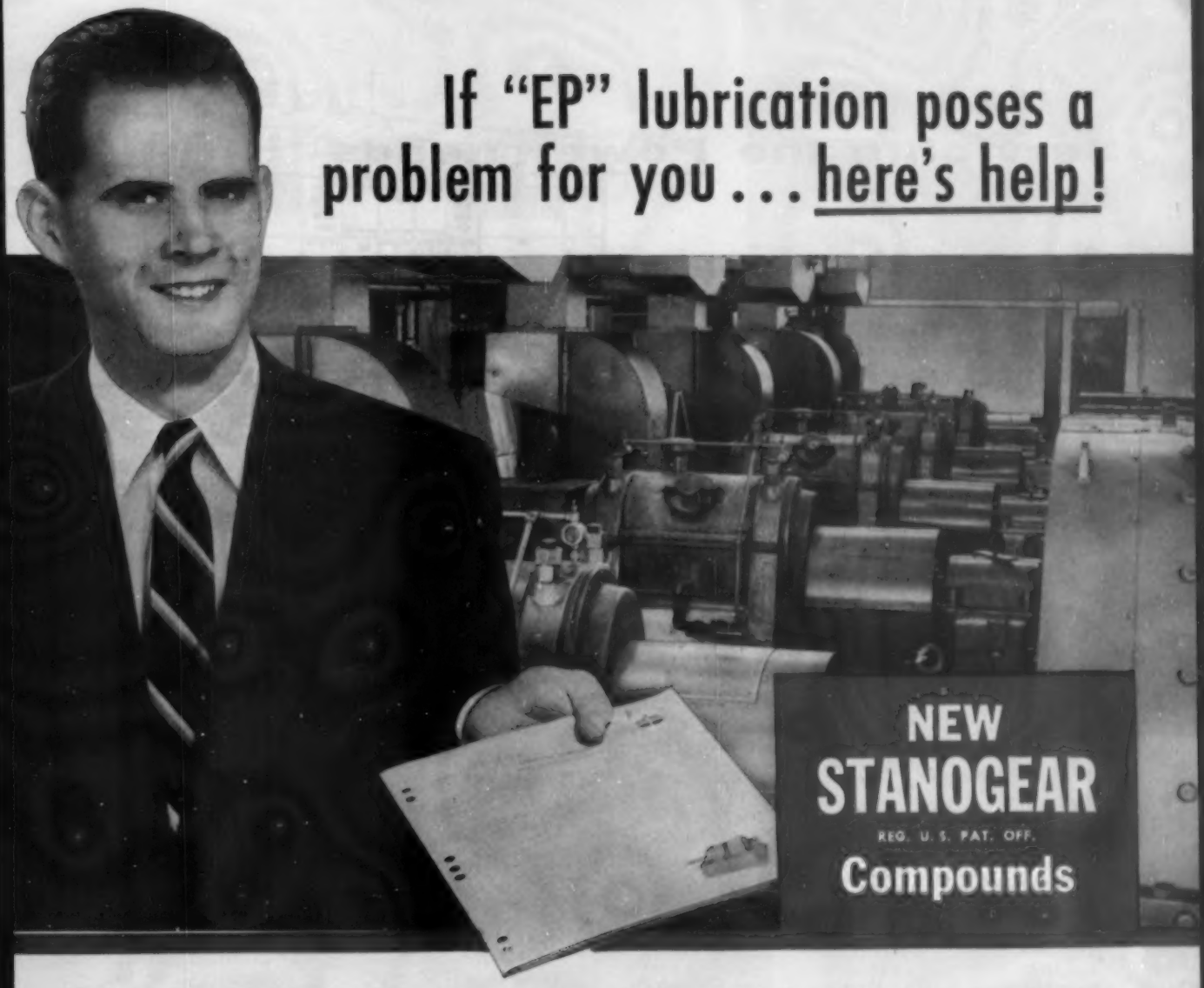
Factory-applied oxide inhibiting compound seals the joint from air and moisture, and copper-alloy construction protects the ductile aluminum cable from mechanical damage by electrical equipment clamps. The heavy coat of tin plate resists galvanic corrosion. As shown by the graphs, aluminum cable with adapters also performed as well as copper cable.

The adapter is installed by driving it on the cable with a pliers or hammer. Then the adapter-cable assembly is inserted under the equipment clamp. The spring pressure of the split tang against the clamp locks it in place.





If "EP" lubrication poses a problem for you . . . here's help!



Here's new technical letter on Stanogear Compounds—send for free copy today!

If you've been having lubricating problems with overloaded or shock-loaded gears on your equipment, New STANOGEAR Compounds—with 7 better EP lubricating features—are made just for you. New and improved STANOGEAR Compounds are recommended for industrial gear applications where the operating conditions of the gear unit demand an extreme pressure lubricant . . . their superiority has been proved in test after test and *on the job!*

New STANOGEAR Compounds work seven ways better to solve your EP problems: **1.** higher load-carrying capacity **2.** superior retention of load-carrying capacity **3.** freedom from objectionable deposits **4.** excellent storage stability **5.** good water separation **6.** anti-foaming **7.** increased versatility

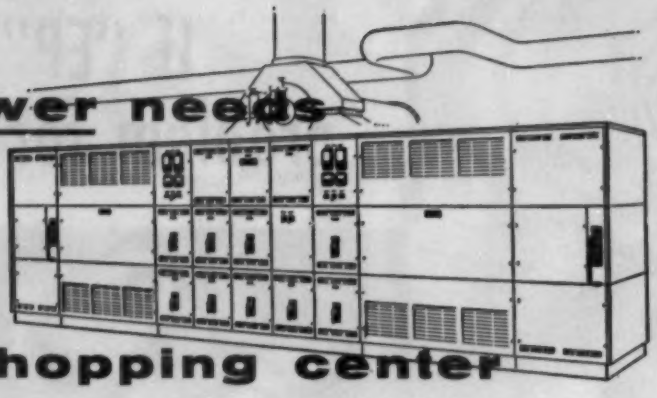
Now Standard Oil has prepared a special technical letter to give the complete story on STANOGEAR Compounds and EP lubrication. For your copy of this factual, informative bulletin, call your nearest Standard Oil office. The Standard Oil lubrication specialist there can answer your questions and send you a copy of the EP story, without obligation. Or write to: Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY

STANDARD (Indiana)

Circle 509 on Reply Card for more data

Servicing the Power needs of the world's largest shopping center



Northland—gigantic, ultra-modern shopping center of the J. L. Hudson Company—offers suburban Detroit the utmost in shopping convenience. The Hudson Building, hub of the Center, is surrounded by five tenant structures, housing approximately 80 different stores.

An extensive electrical system, capable of supplying electricity for some 25,000 homes, brings Northland to life. From primary power to ultimate use, this system represents an outstanding example of commercial planning and foresight. I-T-E Unit Substations—channeling power throughout this shopping empire—are strategically located to provide maximum protection, control, and continuity of service.

Only the finest has been installed at Northland. Electrical distribution equipment—of fundamental importance—must be rugged and dependable to service such demanding power needs.

at Detroit's

NORTHLAND PROJECT

vital energy for a shopping wonderland
supplied by I-T-E dry-type, double-ended Unit Substations

Eleven I-T-E metal-enclosed Unit Substations, rated 1500 and 2000 kva, service the Center's immense lighting and power requirements. And to assure service continuity, Northland's electrical system features I-T-E Selective Tripping devices on the circuit breakers, which *isolate* system faults by interrupting only the circuit nearest the fault.

From the start, important engineering aid was given Northland by I-T-E application engineers. Thanks to this close cooperation, power distribution equipment was on hand *when needed* to fit right in with tight construction schedules.

I-T-E is proud of its place as a *major* contributor of quality power distribution equipment for the "world's largest shopping center."

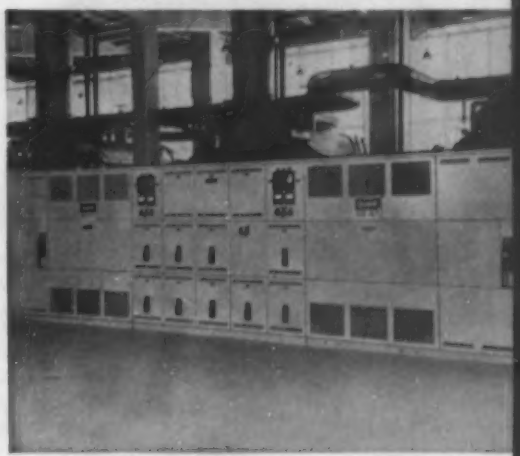
AT NORTHLAND—
I-T-E Substations service:

interior lighting	escalators
exterior lighting	pumps & blowers
display lighting	air conditioning
elevators	compressors
conveyors	refrigeration

For details contact the I-T-E field office nearest you. Look in your classified directory under "Electric Equipment."

I-T-E UNIT SUBSTATIONS
service all interior lighting needs of the Center.

I-T-E UNIT SUBSTATIONS
installed in basement of Hudson Building for 4800—120/208 volt lighting distribution.



I-T-E UNIT SUBSTATION
installed in Utility House for 4800—480 volt power distribution.

THE SYMBOL OF QUALITY SWITCHGEAR

I-T-E CIRCUIT BREAKER COMPANY
19TH AND HAMILTON STREETS, PHILADELPHIA 30, PA.

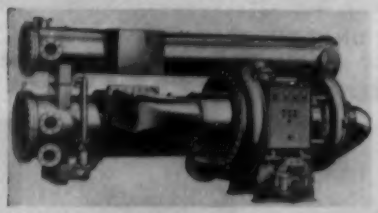
UNIT SUBSTATIONS

Circle 510 on Reply Card for more data

new equipment

—Starts on page 8

Called Hewlite Tank Wagon Hose, it has an oil resisting tube and cover, and spiralled wire reinforcement.

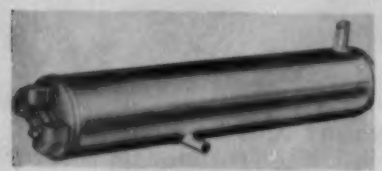


Controls are interlocked for added safety

G34 Three larger size CenTraVac chillers for comfort or process air conditioning are introduced by the Trane Co. With these units, the line now includes eight sizes from 45 to 400 tons capacity. The units start, stop, and run automatically with the controls interlocked for added safety. A bulletin is available.

Small parts storage cabinet

G35 "Swing-Bins" create extra space for dozens of small items. The cabinets are available in six, twelve, eighteen, and twenty-four drawer models. Akro-Mils, Inc.



Freon condensers offered in two types

G36 The new line of ASME constructed and stamped extended surface Freon Condensers announced by Bell & Gossett Co., includes two styles. The model CFG shell and coil condensers are designed for small tonage installation, 2,3,5,7, and 10 ton sizes. The model CRF condenser is available in 2-25 ton sizes and is a straight tube unit with removable heads.

Starters provide maximum explosion protection

G37 Electric Controller & Mfg. Co. announces a new line of Class I Group D motor starters designed for use where hazardous atmospheres and severe corrosive service conditions are encountered. All connections, terminals, arcing parts, and main line disconnect switches are oil-immersed. The starters are of Valimitor type and provide overall short circuit protection for 2200 to 5000 volt motors, irrespective of the magnitude of the fault or of available capacity.

TO REQUEST ADDITIONAL DATA

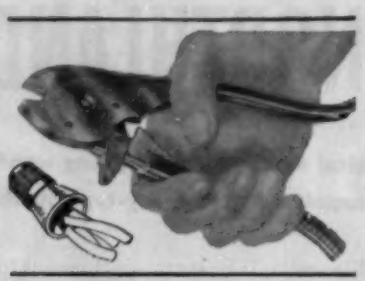
Circle "key" numbers on Reply Card between pages 36/37 & 92/93. Your requests will be handled promptly.

Silicon roof coating remains waterproof longer

G38 The Monroe Co., Inc. has combined silicons with Canadian asbestos, asphalt, and non-evaporating waterproofing oils to produce a roof coating of unusual durability, known as Rufferseal. The material is easily applied without heating, and can be brushed or sprayed on surfaces of any size.

Dehydrator designed for isolated equipment

G39 The Dehydrafilter introduced by Hakison Corp. is a small desiccant air and gas dehydrator designed especially for isolated pneumatic equipment. Rated at 1 scfm at 100 psig and 70 F, it features a disposable desiccant cartridge and "O" ring seal construction which eliminates the need for tools to change the cartridge.



Tool and splicing connector reduce wiring time

G40 For use on building, equipment, and appliance wiring, Buck Electrical Manufacturing Co. is introducing Nycap, a pre-assembled Nylon insulated splicing connector, and Nycapper, a light-weight versatile wiring hand tool. Nycaps are approved for use on all stranded wire from (2) #18 to (4) #12, and for high temperature applications up to 221 F.

Cylinder, positioner unit for combustion control

G41 A compact assembly consisting of a Stabiload power cylinder and Cylinder Positioner, developed by The Foxboro Co., will operate dampers, coal gates, valves, variable speed drives, and other combustion control devices requiring up to 6 in. stroke, with no multiplying linkages needed. Technical report TI 31-H-123b will be sent on request.

Breaker allows easy mounting in surface raceway

G42 Deep-bodied device cover known as 1710 CB has been designed by National Electric Products Corp. to accommodate all standard makes of single-pole circuit breakers in sizes from 10 to 50 amp. The fitting is said to be particularly adaptable for

Another great Detroit Stoker.....

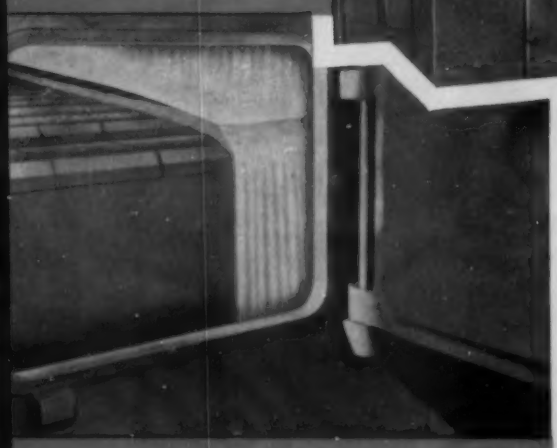
MOST IMPORTANT DEVELOPMENT IN COAL BURNING SINCE INTRODUCTION OF THE DETROIT ROTOGRATE

Detroit RotoStoker Type C-C

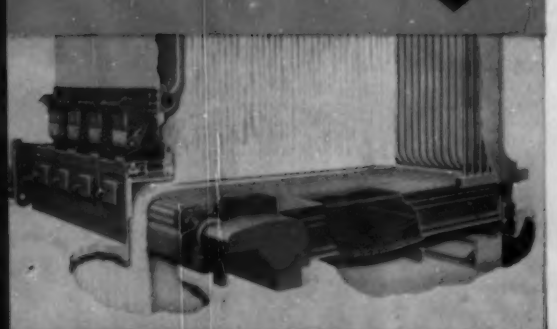
(CONTINUOUS CLEANING)

Detroit RotoStoker Type C-C discharges ash continuously at the front.

Detroit RotoStoker Type C-C (Continuous Cleaning)



Detroit RotoGrate Stoker—Traveling Grate Spreader Stoker



Users of medium and small size steam generators may now have the long proven advantages of continuous ash discharge spreader stoker firing with the Detroit RotoStoker Type C-C.

CHECK THESE ADVANTAGES:

- Cleans Fuel Bed and Discharges Ash Continuously at the front.
- Smokeless Operation Through a Wide Load Range
- Efficiently Burns Bituminous Coals and Lignite.
- Insures Continuous Uninterrupted Steaming Capacity and High Availability.
- Responds quickly to Fluctuating Loads
- Fuel Feeders Handle High Moisture Coals Easily and Without Clogging
- Operation Automatic and Dependable
- Easily Applied to Existing Boilers—No Basement Necessary
- Design results in Low Maintenance
- Many Sizes Available to Develop from Approximately 5,000 to 75,000 Pounds of Steam Per Hour

For large steam generators Detroit RotoGrate Stokers have proven their merit for more than fifteen years. The *first and foremost* traveling grate spreader stoker, the Detroit RotoGrate Stoker was first to establish the tremendous advantages of continuous ash discharge, spreader stoker firing.

DETROIT STOKER COMPANY

GENERAL MOTORS BLDG., DETROIT 2, MICH.

Works at Monroe, Mich. • District Offices in Principal Cities

THE WICKES BOILER CO

WICKES

3-drum boiler at KEELER BRASS COMPANY

Installation of a new 3-drum WICKES Water Tube Steam Generator has substantially increased operating efficiency at the Keeler Brass Company, Grand Rapids, Michigan, the world's largest manufacturer of furniture hardware. The new boiler, a combination oil-fired and underfeeder stoker unit, is capable of producing 40,000 lbs. of steam per hour at 350 psi.

WICKES will design and build water tube steam generators for any practical size and pressure. WICKES also offers a wide choice of auxiliary equipment so that it's possible for you to get not only the best steam generator, but also the best correlated equipment. Contact your nearest WICKES sales representative or write us today.

OUR 100th YEAR

THE WICKES BOILER CO.

DIVISION OF THE WICKES CORPORATION • SAGINAW, MICHIGAN

RECOGNIZED QUALITY SINCE 1854 • **SALES OFFICES:** Albuquerque, N. M. • Boston • Buffalo • Charlotte, N. C. • Chicago • Cleveland • Dallas • Denver • Detroit • Fort Wayne, Ind. • Houston • Indianapolis • Los Angeles • Memphis • Milwaukee • New York City • Portland, Ore. • Saginaw • Salt Lake City • San Francisco • Springfield, Ill. • Tampa, Fla. • Tulsa • Washington, D. C.

155

Circle 512 on Reply Card for more data

The MODERN Steam Trap

Moving parts, particularly in steam traps, are subject to to corrosion, pitting, sticking and breaking.

When this occurs the trap no longer functions. Time sometimes elapses before the failure is detected. The trap must then be dismantled and repaired. Production is interrupted. Costs go up.

Drainator — the modern steam trap — avoids these difficulties by eliminating the parts which cause them. It has not a single moving part but is operated by properties in the steam. A fluctuating gauge glass signals that the trap is functioning properly.

Modernize your steam using equipment by installing the modern steam trap. Write for the complete and interesting story now.

THE COE MANUFACTURING COMPANY
502 BANK STREET • PAINESVILLE, OHIO

Gentlemen:

Please send us literature describing items checked

☐ COE Drainator Steam Traps
☐ COE Safety Water Heater

Name_____

Address_____ City_____

Company_____

Circle 513 on Reply Card for more data

new equipment

—Starts on page 8

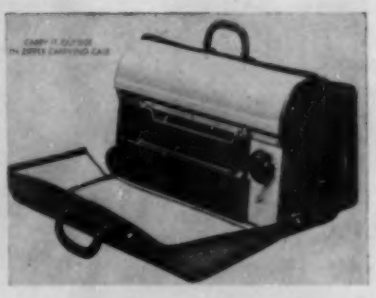
surface raceway installation where individual circuit breaker control is desirable for air conditioning units or other applications.

Sheathed cable is small in diameter

G43 Improved nonmetallic sheathed cable for the electrical industry is being offered by Triangle Conduit Cable Co., Inc. in sizes 14/2 through 4/3. Known as the Silver Glazon Triex, the cable is non-flaking, cleaner, smoother, lighter, and easy to strip.

TO REQUEST FREE BULLETINS

Circle "key" numbers on Reply Card between pages 36/37 & 92/93. Your requests will be handled promptly.



Portable copying machine is low cost, self contained

G44 In two steps a finished copy can be made by an inexperienced operator in less than 45 sec. with the Apeco "Private Eye" Auto-Stat. Made by the American Photocopy Equipment Co., the light-weight, portable machine takes up little more space than a desk tray.

Hose recommended for use with alkaline cleaners

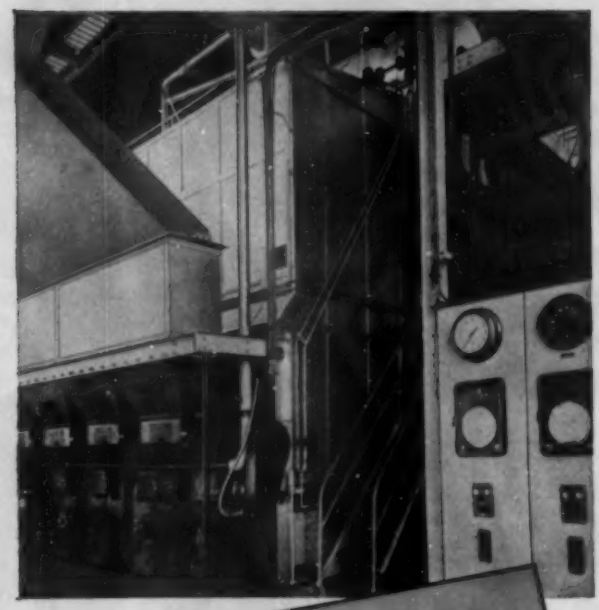
G45 Steam cleaner hose Style MH is designed to handle the difficult requirements of steam-cleaning application according to Goodyear Tire & Rubber Co. Available in ½ and ¾ in. sizes, it is recommended for use at 100 lb water pressure where alkaline

"HOW WE SAVE MORE THAN $90,000 A YEAR—

BY BURNING COAL THE MODERN WAY!"

says W. H. FISHER, Plant Engineer, Kerr Bleaching and Finishing Works, Concord, North Carolina.

"Powering our plant used to take nine boilers—now *one* does the same job *using 30% less fuel!* 6 firemen now do the work of 18—thanks to modern coal-handling equipment and automatic controls. That's why we say, you can't beat bituminous coal burned with modern equipment."



Above is a view of the plant's modern, space-saving coal-storage silo. To the left is a close-up of the firing aisle, showing the spreader stoker and the main control panel. Coal handling is automatic and dust-tight throughout. Automatic controls regulate firing, drafts and feed-water—give maximum efficiency at lowest cost.

If you operate your own steam plant, you can't afford to ignore these few down-to-earth facts!

COAL in most places is today's lowest-cost fuel.

COAL resources in America are adequate for all needs—for hundreds of years to come.

COAL production in the U. S. A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

Burning coal the modern way can save *you* money, too! First, labor costs can be cut to a minimum with up-to-date coal- and ash-handling equipment. On top of that, today's combustion installations give you 10 to 40% more power from each ton of coal than was possible a few years ago!

If you're planning to modernize, or if you're building a new plant, call in a consulting engineer. He'll show you how you can get big savings by burning coal in a modern plant designed to meet your *specific* needs.

America's coal reserves are virtually inexhaustible; America's coal industry is the world's most productive and efficient. That's why coal has a future dependability of supply that no other fuel can offer. That's why, of all fuels, the price of coal is most likely to remain stable.

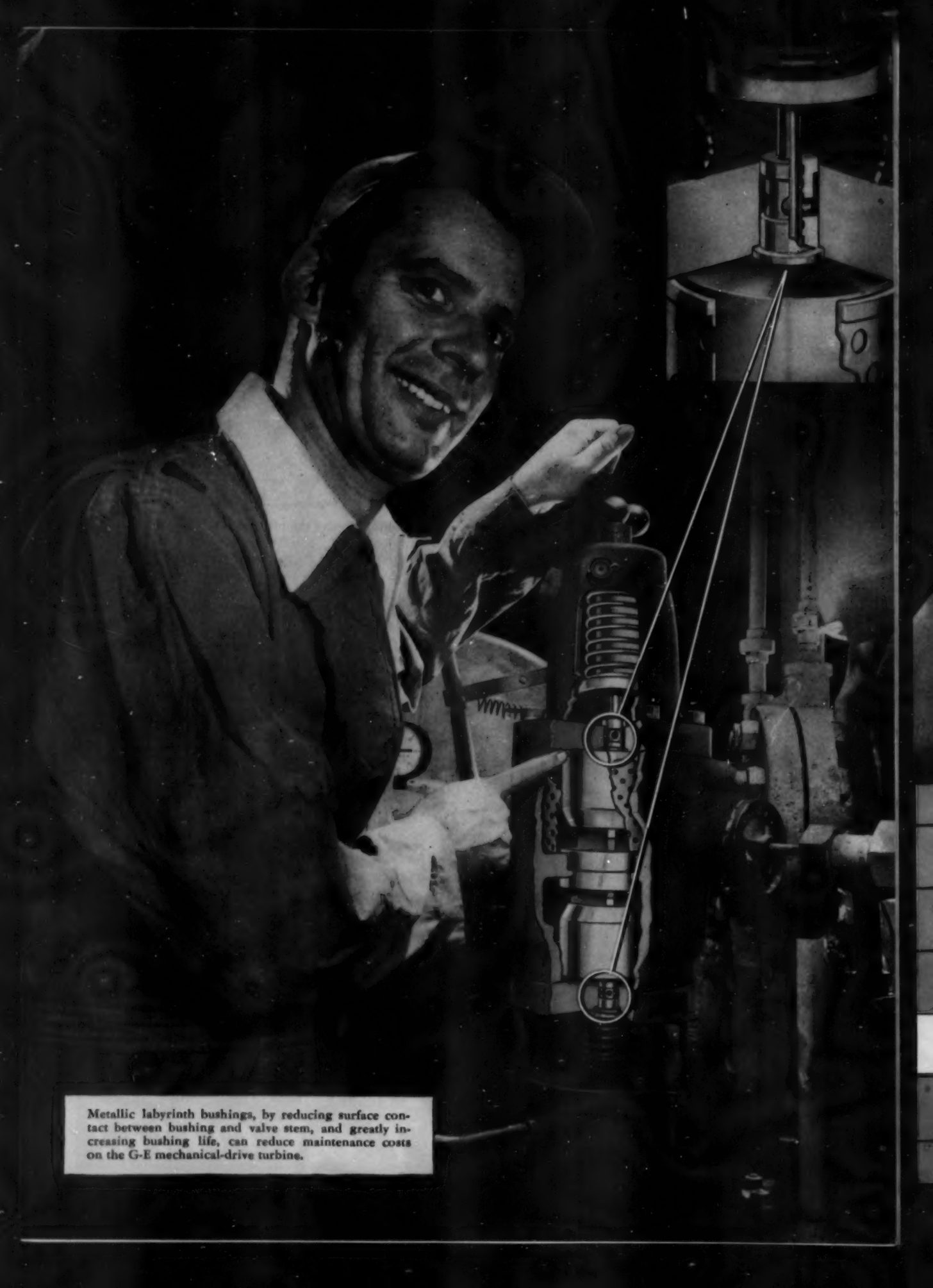
BITUMINOUS COAL INSTITUTE

A Department of National Coal Association, Washington, D. C.

FOR HIGH EFFICIENCY — FOR LOW COST

YOU CAN COUNT ON COAL!

Circle 514 on Reply Card for more data



Metallic labyrinth bushings, by reducing surface contact between bushing and valve stem, and greatly increasing bushing life, can reduce maintenance costs on the G-E mechanical-drive turbine.

ANOTHER PLUS VALUE OF G-E MECHANICAL-DRIVE TURBINES...

Metallic Labyrinth Bushings Cut Turbine Maintenance Costs

Using metallic labyrinth bushings instead of soft packing on the throttle valve stem and operating valve stem of General Electric's Type DP mechanical-drive turbine has several important advantages. Corrosive attacks on the valve stems, often caused by soft packings, are prevented.

Because surface contact between bushing and valve stem is reduced to a minimum, friction is practically eliminated—bushing life is increased tremendously. This feature alone can save you up to $50.00 in direct maintenance costs—plus the expense of down-time caused by frequent packing replacements.

HERE'S ANOTHER ADVANTAGE. Since frictional drag on the governing system is reduced to a minimum, you get more accurate, sensitive, reliable governing with G.E.'s Type DP turbine.

Metallic labyrinth bushings make an effective steam seal by means of grooves in the bushing which throttle pressure and minimize any steam leakage (see illustration).

THESE METALLIC LABYRINTH BUSHINGS are just one of many DP features which save you money throughout total turbine life. The chart below indicates other areas of savings.

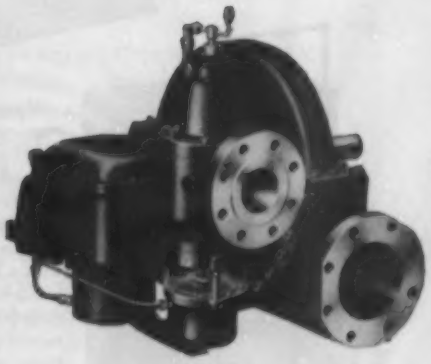
Remember—the total cost is often more than just the sales price. But G.E.'s standard DP turbines include the extra features that save you extra costs. For more information contact your nearest G-E apparatus sales office. Write for bulletin GEA-4955A, "A New Standard in Mechanical-drive Turbines." General Electric, Schenectady 5, N.Y.

B51-68

GENERAL ELECTRIC

INSTALLATION AND MAINTENANCE COST-SAVING FEATURES

THESE EXTRA FEATURES, STANDARD ON ALL G-E TYPE DP TURBINES, CAN . . .	Save You up to
COMBINED TRIP-THROTTLE VALVE Eliminate extra cost of buying and installing valve ahead of the turbine.	$200.00
SINGLE RESERVOIR FOR COOLING LUBE OIL Eliminate extra cost of piping cooling water to and between bearings.	50.00
MAJORITY OF PARTS INTERCHANGEABLE One set of spare parts protects several units—less money tied up in inventory.	100.00
METALLIC-LABYRINTH VALVE STEM BUSHING Eliminate labor costs of replacing soft packings; cut down-time production losses.	50.00
SHAFT MONEL-SPRAYED AT PACKING FIT Saves frequent cost of purchasing and installing carbon rings; contributes to long shaft and packing life.	20.00
ESTIMATED TOTAL SAVINGS	$420.00



G-E Type DP Mechanical-drive Turbine

COMPARE THE FEATURES
EVALUATE ALL THE COSTS

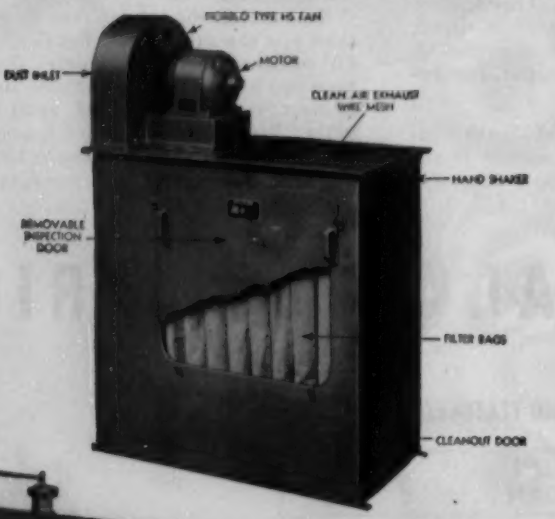
See why G-E Standard Type DP turbines are your most economical buy.

Circle 515 on Reply Card for more data

Keep workroom air clean—
protect work and workers with

Norblo

Portable bag-type Dust Collectors



Many plants can be effectively and profitably equipped with Norblo Portable and Semi-Portable Dust Collection Units, to remove unhealthful and sometimes dangerous contaminants from dust-producing machines. Localized dust control for grinding, polishing, sawing and other operations is thus provided at much lower cost than with a large centralized system.

Norblo Portables occupy small space, can be elevated to save floor area. And they're easily moved if re-location of machines proves desirable. Units are available in various arrangements for dust clean-out. Six sizes range from 300 to 1350 C.F.M., operate at 8" static pressure at the fan. Also larger sizes—semi-portable. Write for Bulletin 163-5.

The Northern Blower Company

Engineered Dust Collection Systems for All Industries

6422 Barberton Ave. OLympic 1-1300 Cleveland 2, Ohio

Circle 516 on Reply Card for more data

new equipment

—Starts on page 8

based cleaning solutions are employed. It is not recommended for chlorinated solutions.

Improved Lighting Diffuser

G46 The larger Grate Lite announced by the Edwin F. Guth Co. will make possible the use of fewer panels in complete ceiling type installations, and will also be used in the 16 in. wide fixtures now being introduced by the company. Because of its openness and low absorption factor, Grate Lite is said to maintain high illumination values.

Wrenches provide extra gripping power

G47 Snap-on Tools Corp. announces a new series of four combination open end Boxocket wrenches with single hexagon openings on the Boxocket end. These single hex openings provide extra gripping power for slightly undersized or chew-up nuts and on Parker-Kalon self tapping screw with rounded corners.

Chargers available for 10 to 42 cell batteries

G48 The Lincoln Electric Co. announces production of a line of battery chargers in three models available to cover charging requirements for Edison batteries of 10 to 42 cells. The correct charging rate for any battery is set with a single charging current control. The only other control required for operation of the unit is the time control. This automatically starts the unit, con-

How to make certain your pipe hanging jobs are

RIGHT ON THE BEAM

THERE'S A STOCK GRINNELL HANGER FOR EVERY PIPING REQUIREMENT

With Grinnell Pipe Hangers you get better, stronger installations in less time. You not only save money on assembly — but on costly call-backs and maintenance, because Grinnell Hangers permit adjustment *after* pipe is erected. This makes it easy for you to correct sagging pipe, water traps . . . to provide positive drainage for the entire system.

Remember, there's a stock Grinnell hanger for every piping installation . . . from a simple water pipe to a high pressure, high temperature steam line. Where necessary, there are Grinnell engineered hangers to compensate for thermal movement.

Make sure your piping installations are *right on the beam.* Let Grinnell supply the correct hangers to meet all your needs. Grinnell hangers comply with piping code requirements.

GRINNELL

AMERICA'S #1 SUPPLIER OF PIPE HANGERS AND SUPPORTS

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

Manufacturer of: pipe fittings • welding fittings • forged steel flanges • steel nipples • engineered pipe hangers and supports
Thermolier unit heaters • Grinnell-Saunders diaphragm valves • prefabricated piping • Grinnell automatic fire protection systems

Circle 517 on Reply Card for more data

Subox

PROTECTS THEM ALL

Oil storage tanks or coal handling equipment...water tanks or ash collectors, metal surfaces everywhere...all are dependably protected against rust and corrosion when the SUBOX PAINT SYSTEM is used. In every case, longer life, minimum maintenance costs, and simplified future upkeep are assured.

Formulated on a rust-inhibitive, lead-suboxide base, every SUBOX & SUBALOX paint thoroughly resists corrosion...is hard, yet flexible enough to withstand rapid and frequent temperature changes; weathers well, and gives excellent protection against industrial fumes, moisture, and abrasion.

Each coat has the same tough durable lead base assuring excellent adhesion and eliminating the possibility of film separation, peeling, chipping or cracking. As the lead film wears thin, the established coat can be built to original film thickness and its life extended for another long period — no special primers or finishers required — with just one single maintenance coat.

Subox Inc.

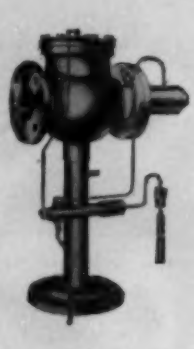
9 Fairmount Plant, Hackensack, N. J.

Circle 518 on Reply Card for more data

new equipment

—Starts on page 8

nects the battery to the charging circuit, and stops the unit when the battery is fully charged. A completely discharged battery can be brought up to full charge in seven hours.



Temperature control is rugged, yet sensitive

G49 Temperature control valve No. 1549, announced by Klipfel Valves, Inc., is pilot operated for sensitive dependable service, and is a tight closing type of valve. It has a 50 F range of adjustment and is manufactured in sizes from ¾ to 6 in. Literature is available.

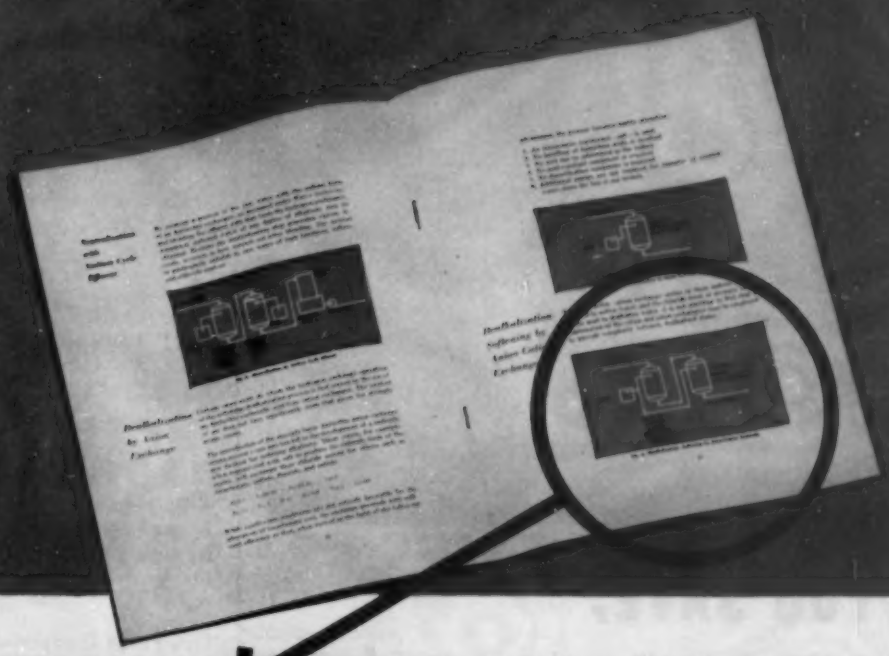
TO REQUEST FREE BULLETINS

Circle "key" numbers on Reply Card between pages 36/37 & 92/93. Your requests will be handled promptly.

Unit provides pressure and temperature protection

G50 Type RHV revolving head automatic reseating temperature relief valves introduced by A. W. Cash Valve Mfg. Corp. permit on-the-job pressure adjustments without the use of an auxiliary pressure gage. Inbuilt thermostatic element opens when water is overheated and closes when water has cooled. Literature is available.

AMBERLITE ION EXCHANGE RESIN REDUCES ALKALINITY WITHOUT ACIDS OR DEGASIFIERS



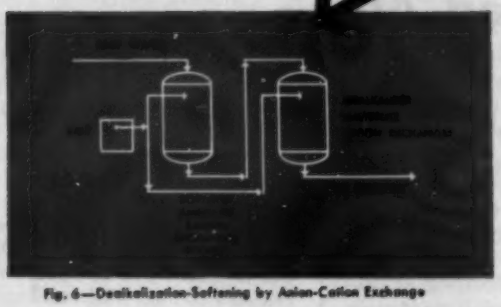


Fig. 6—Dealkalization-Softening by Anion-Cation Exchange

A strongly basic AMBERLITE anion exchange resin permits control of alkalinity of water supplies for boilers and cooling systems conveniently and at low cost. Only common salt is required as regenerant for the resin. No acids are used, hence expensive acid-resistant equipment and associated handling problems are eliminated. Because no degasifier is required, line pressure is not broken, and pumping costs are reduced.

New Book Gives Valuable Information on Water Treatment Problems

Rohm & Haas Company's new book, *If You Use Water*, discusses this up-to-date technique —and many other ion exchange methods of water treatment as well. Softening, combination softening-dealkalization, silica removal, deionization, are just some of the topics considered. Your request for this book will bring you a copy promptly, will show you why in ion exchange the resin that's *right* is AMBERLITE.

Send for your free copy of this book today

CHEMICALS FOR INDUSTRY

ROHM & HAAS COMPANY

THE RESINOUS PRODUCTS DIVISION

Washington Square, Philadelphia 5, Pa.

Representatives in principal foreign countries

AMBERLITE is a trademark, Reg. U.S. Pat. Off. and in principal foreign countries.

Circle 519 on Reply Card for more data

ROHM & HAAS COMPANY

Washington Square, Philadelphia 5, Pa.

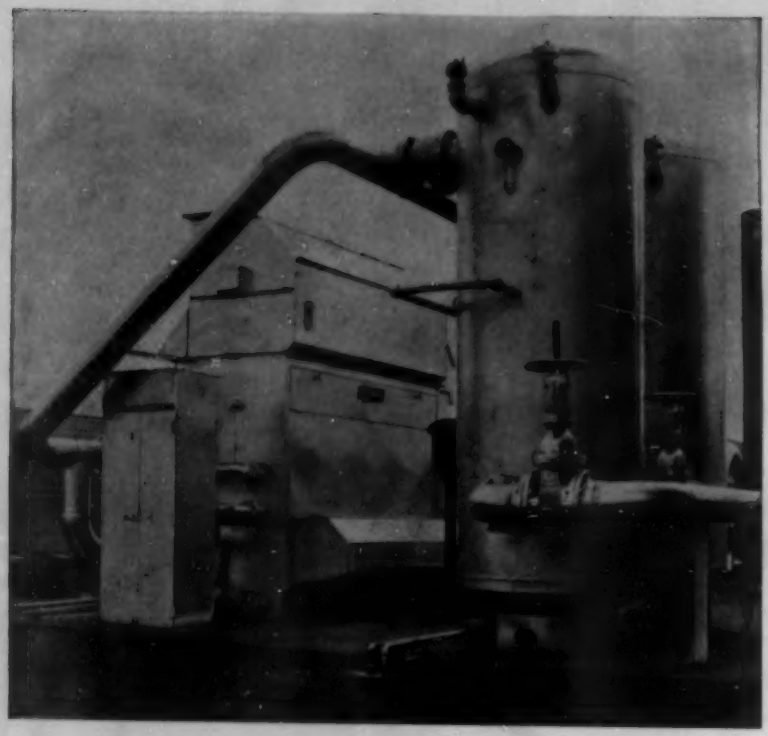
Please send me a copy of "If You Use Water..."

Name_____

Title_____

Address_____

City_____ Zone____ State_____



HOW YOU SAVE,

Getting Drier Compressed Air

● Direct saving in the cost of cooling water saves the price of the Niagara Aero After Cooler (for compressed air or gas) in less than two years.

Extra, for no cost, the drier air gives you a better operation and lower costs in the use of all air-operated tools and machines, paint spraying, sand blasting or moisture-free air cleaning. Water saving also means less expense for piping, pumping, water treatment and water disposal, or you get the use of water elsewhere in your plant where it may be badly needed.

Niagara Aero After Cooler assures all these benefits because it cools compressed air or gas below the temperature of the surrounding atmosphere; there can be no further condensation in your air lines. It condenses the moisture by passing the air thru a coil on the surface of which water is evaporated, transferring the heat to the atmosphere. It is installed outdoors, protected from freezing in winter by the Niagara Balanced Wet Bulb Control.

Write for complete information; ask for Bulletin No. 98

NIAGARA BLOWER COMPANY

Dept. I.P. 405 Lexington Ave. New York 17, N. Y.

Niagara District Engineers in Principal Cities of U. S. and Canada

INDUSTRIAL COOLING HEATING • DRYING

NIAGARA

HUMIDIFYING • AIR ENGINEERING EQUIPMENT

Circle 520 on Reply Card for more data

letters

. . . from readers

Out of Print

Sir:

I enjoyed the article "Coal Burning Equipment—Application and Selection" by Earl C. Miller, very much.

He mentioned at the end of the article pulverized anthracite burning.

I would like very much to get a copy of the paper "Operation of Sunbury Steam Electric Station Using Pulverized Anthracite Fuel," by T. B. Richards.

Anthony F. Sidlow
Air Pollution Control Engineer
Green Bay, Wis.

—This ASME paper (No. 52-FU-3) is out of print but the Society will furnish photostats upon request to the New York office.—Ed.

Free Piston Compressor

Sir:

In your January issue you mentioned a free piston diesel compressor ("Compressors and Compressed Air," Industrial Development Review issue, page 72).

I would like to know where to write for more information.

Several months ago I wrote to you in regard to an oil positive reduction hydraulic transmitter. The Oil Gear Co. to whom you referred me suggested I contact Vickers, Inc.

I now have a Vickers Unit and it is serving my purpose very well.

R. O. Greeves
Wind Wheel Mine
Columbia, Calif.

—Mr. Greeves was referred to Alan Muntz Co. Ltd., Hounslow, England. —Ed.

Research Project

Gentlemen:

. . . . thank you for the editorial material you supplied us with. This will be a great help in a research project we have underway.

W. A. Cather III
Michel-Cather, Inc.
New York City

COOL HEADS IN "HOT SPOTS" WON'T LET YOU DOWN

On jobs where the air is foul or hot, men can't be blamed too much for letting up now and then. If you want to keep their efficiency and morale high, feed them better air.

Employers have learned the value of putting Coppus Blowers and Ventilators on the job . . . in confined areas and near furnaces or hot processes. The men work faster, do better work, work longer without fatigue — and appreciate the more comfortable working conditions.

Give some thought now to the "hot spots" in your plant. There is a Coppus Blower for practically any requirement — Cable Manhole and Tank Ventilators, Boiler Manhole Blowers and Exhausters, Heat Killers, Shiphold Ventilators, etc. The Coppus "Blue Ribbon" is your assurance of design and construction planned for plenty of severe service. Check and mail the coupon for specific information. Coppus Engineering Corp., Worcester 2, Mass. Sales Offices in THOMAS' REGISTER. Other "Blue Ribbon" Products in BEST'S SAFETY DIRECTORY, CHEMICAL ENGINEERING CATALOG, REFINERY CATALOG.

ANOTHER
COPPUS
"BLUE RIBBON" PRODUCT

COPPUS ENGINEERING CORP., 187 PARK AVENUE, WORCESTER 2, MASS.
Please send me information on the Blowers that clear the air for action.

- ☐ in tanks, tank cars, drums, etc.
- ☐ in underground cable manholes.
- ☐ in aeroplane fuselages, wings, etc.
- ☐ on coke ovens.
- ☐ on steam-heated rubber processes.
- ☐ on boiler repair jobs.

COOLING:

- ☐ motors, generators, switchboards.
- ☐ wires and sheets.
- ☐ general man cooling.
- ☐ around cracking stills.
- ☐ exhausters, welding fumes.
- ☐ stirring up stagnant air wherever men are working or material is drying.

NAME.....
COMPANY.....
ADDRESS.....
CITY.....

(Write here any special ventilating problem you may have.)

Circle 521 on Reply Card for more data

WORTHINGTON DC-2 COMPRESSORS are installed in the Libbey-Owens-Ford Glass Company's Fiber-Glass plant in Parkersburg, West Virginia. They have five-step variable capacity controls enabling them to operate with a minimum power consumption.

Compressed air helps turn a single glass marble into 42 miles of textile filament!

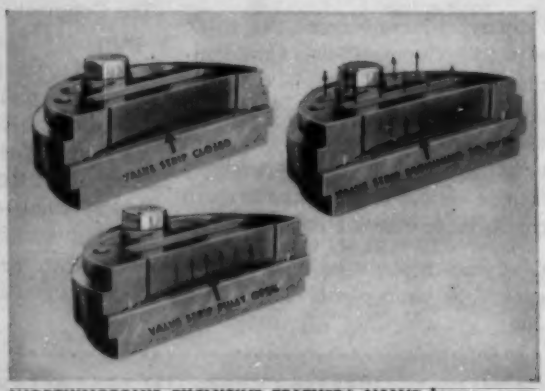
Libbey-Owens-Ford uses Worthington compressors in the manufacture of fiber glass

Daily, more than 40 million miles of filament, gathered into strands of fiber glass, twisted into yarns, and woven into industrial cloth, tape and other textile forms, are produced at the Libbey-Owens-Ford plant at Parkersburg, West Virginia.

The fiber glass filament is made by melting specially prepared glass marbles in small furnaces and drawing the glass through the minute apertures of a "bushing". Humidity is important in handling these continuous fibers of glass and compressed air is used to maintain accurate man-made weather. Compressed air is actually used in 22 important operations in making fiber glass in this ultra-modern factory.

Three Worthington DC-2 compressors, each with five-step capacity control, supply the air pressure required in these many delicate tasks.

Whatever your requirements for compressed air, Worthington builds compressors to meet them. Write us about your compressor problems. Worthington Corporation, Compressor Division, Section K.4.1, Buffalo, N.Y.



WORTHINGTON'S EXCLUSIVE FEATHER* VALVE lowers compressor fuel consumption. A series of thin flexible strips of ribbon steel lift and flex uniformly as shown. This lightest, tightest, most durable valve ever made is standard on all Worthington compressors. *Reg.U.S.Pat.Off.

K.4.1

WORTHINGTON

Only Worthington Compressors give you Feather Valve Performance

T-Types • Balanced Angle • Horizontal • Portable • Radial • Gas Engine Compressors

Circle 522 on Reply Card for more data

Circle 523 on Reply Card for more data

Proof of PERFECT* Water Treatment PERFORMANCE

Nearly 12 billion pounds of steam have been generated inside this boiler and its twin. Boilers have never been acid cleaned. Tubes have never been turbined. All water side surfaces are clean-to-metal.

TURN THE PAGE FOR MORE FACTS ON HOW IT WAS DONE

*We at think at least 99%!

BOILER OPERATING DATA

● Two new boilers were put on line in a Southwestern municipal utility plant at the same time late in 1949. Rated capacity of each unit is 250,000 pounds of steam per hour at 950 p.s.i. Normal operating rates range from 150,000 to 175,000 pounds of steam per hour per unit.

The Nalco System of water treatment has been used continuously in these boilers. Raw water softening is by Nalcite* Ion Exchange Resins, and other Nalco products are used for after-treatment, internal treatment, and condensate return line protection. Results have been perfect. Boilers have never been turbined or acid cleaned, and are opened only for annual internal inspection.

Registered Trademark

CLEAN . . . FOR TOP HEAT TRANSFER EFFICIENCY
What appear to be chalk marks in this untouched photo are scrape marks which indicate only the usual powdery film left on the metal when the boiler is drained.

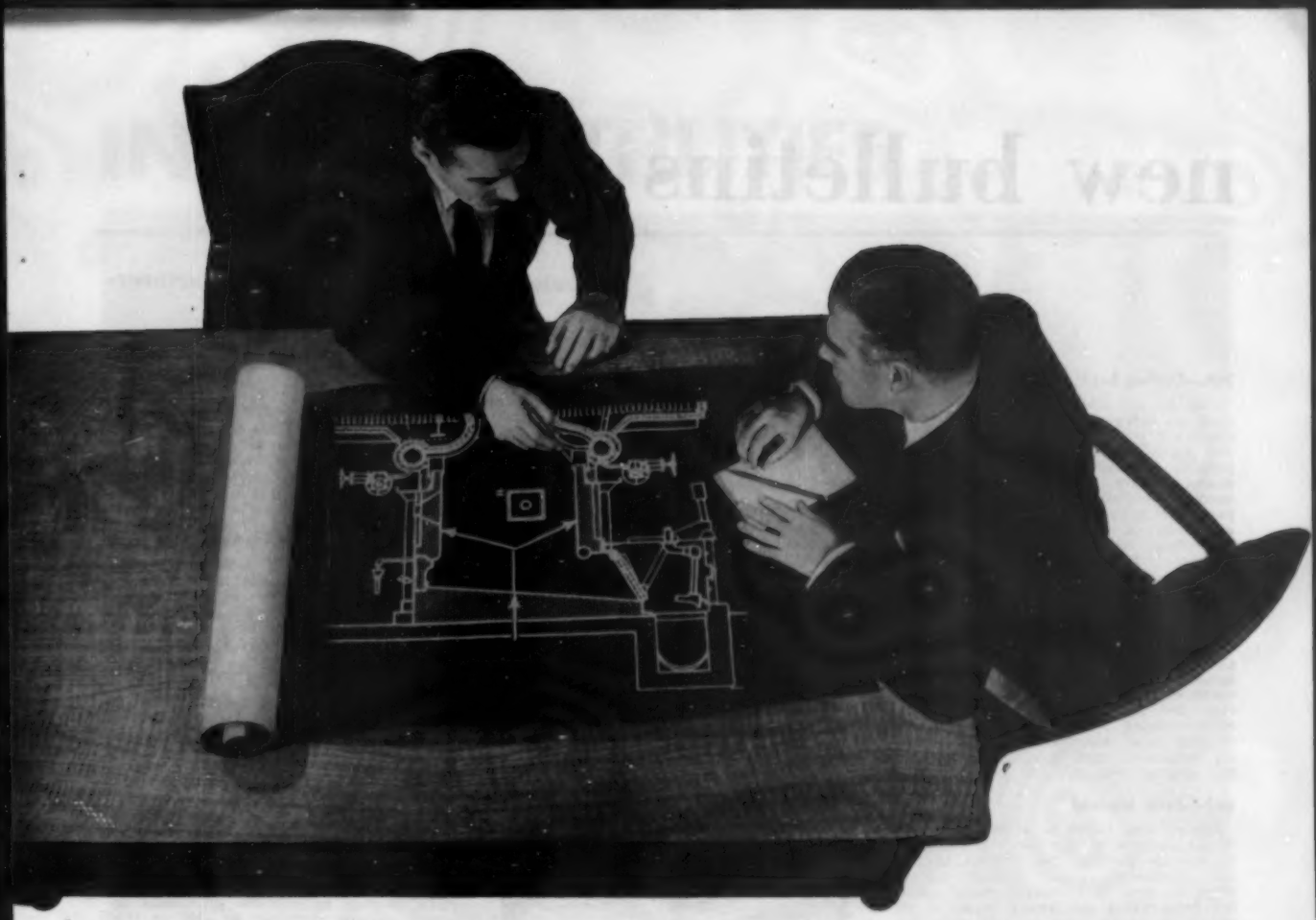
AND THE MUD DRUM IS SPOTLESS, TOO!
Another untouched photo inside the mud drum of one of the boilers shows the like-new condition after years of service. No deposits or corrosion of any kind have been found in tubes or drums.

Nalco ON THE JOB

● Results like these are encountered every day in plants when the complete Nalco System of water treatment is on the job. The Nalco System is adaptable to old and new plants of any capacity, temperature, or pressure. Whether you operate a public utility or a space heating boiler, you will find your Nalco Representative of real assistance in the solution of your water treatment problems. Call him today, or write for full information.

NATIONAL ALUMINATE CORPORATION
6216 West 66th Place • Chicago 38, Illinois
In Canada: Alchem Limited, Burlington, Ontario

THE *Nalco*® SYSTEM . . . Serving Industry through Practical Applied Science



PROMINENT PUBLIC UTILITY

Cuts ashpit maintenance with B&W Refractory Concretes

A trial installation of B&W Refractory Castable "A", a 2600 degree refractory concrete, was made in one boiler ashpit. To date this castable has given 25 months more maintenance-free service than the refractories previously used.

Results of this first trial were so encouraging that another ashpit, shown in the drawing above, was lined with B&W Refractory Castable "A". In this installation the two opposing high velocity water sprays cut refractories life two ways. First, water splattered on the hot walls (about 1800F) caused spalling. Second, the high velocity water jets had an abrasive effect on the floor refractories.

Here's the report: "After 20½ months service, B&W's Castable "A" lining was still in excellent condition—far superior to the refractories used before."

On the basis of these trials three other boiler ashpits have been lined with this 2600 degree castable.

In addition to ashpit linings, B&W Refractory Castable "A" is widely used in boilers for baffles, hearths, door linings, special shapes, repairing eroded brickwork and forming pier walls in stoker-fired boilers.

B&W Castable "A" is only one of a line of B&W Refractory Concretes which cost-conscious furnace operators are putting to increasing use in hundreds of different applications. These B&W Concretes may help you cut installation costs and lengthen furnace life. Consult your B&W Field Engineer.

BABCOCK & WILCOX

THE BABCOCK & WILCOX CO.
REFRACTORIES DIVISION
GENERAL OFFICES: 161 EAST 42nd ST., NEW YORK 17, N.Y.
WORKS: AUGUSTA, GA.

B&W REFRACTORIES PRODUCTS — B&W Allmul Firebrick • B&W 80 Firebrick • B&W Junior Firebrick • B&W Insulating Firebrick B&W Refractory Castables, Plastics and Mortars • OTHER B&W PRODUCTS—Stationary & Marine Boilers and Component Equipment... Chemical Recovery Units ... Seamless & Welded Tubes ... Pulverizers ... Fuel Burning Equipment ... Pressure Vessels ... Alloy Castings

R478A

Circle 524 on Reply Card for more data

new bulletins

. . . catalogs from leading manufacturers

200—Tubing Steel

One of the alloy tubing steels widely used in elevated temperature service is discussed in a technical data card TDC-151. Known as B&W Croloy 9M (8 to 10 percent chromium, 1 percent molybdenum), tubes of this alloy have been used successfully in a broad variety of petroleum conversion equipment. Included are data on mechanical and physical properties, bending, welding, and heat treatment. Tubular Products Div. of Babcock & Wilcox Co.

201—Pipe and Fin Coils

Revised second edition of the "Engineering Data Book on Pipe and Fin Coils" contains such information as calculation of pipe and fin coils, heat transfer coefficients for heating or cooling, factors for computing fin coil surfaces, recommended materials for heating or cooling, heat transfer factors at various air velocities, and Btu load limitations for cooling coil circuits. Rempe Co.

202—Jack Manual

Information keyed to answer questions of all users of lifting jacks is contained in 40-page manual 204. Primed to help cut production costs through helpful hints on how to eliminate waste resulting from using the wrong jacks, it explains in detail how to use, care for, and maintain jacks. Duff-Norton Manufacturing Co.

203—Insulating Brick

"Six Insulating Bricks of Prime Importance to Refractories Users," bulletin EB-D, a revision of a previous issue, includes information on this company's new 3000 F refractory H-W 30. Thermal data chart gives heat losses, heat storage capacities, and cold face temperatures for insulated walls built of various combinations of refractories. Harbison-Walker Refractories Co.

204—Air Circuit Breakers

Bulletin 5107-DR-1 contains four pages of facts, figures, features, and photographs on types KA, KB, KC, and LG Urelite air circuit breakers. There is also information on weather-proof and dust-tight enclosures, plus applications, specifications, and construction details. I-T-E Circuit Breaker Co., Switchgear Div.

205—Production Story

Twenty-two-page brochure M304 carries you through the operations required to manufacture this company's condensers, heaters, evaporators, coolers, and refrigeration equipment. The story starts before the turn of the century and goes on to describe the designing, engineering, and fabricating facilities of the present day. Lummus Co.

206—Water-Tube Steam Generators

Packaged water-tube steam generators Type MH, furnished for oil or gas firing or both, with automatic, semi-automatic, or manual combustion controls, are covered in detail in 16-page bulletin MH3-54. A dimension table for 13 standard sizes ranging in capacity from 10,000 to 40,000 lb of steam per hr is included. Union Iron Works.

207—Telemetering

Two wires do the work of sixty in a new simple telemetering system developed by this company, according to this four-page folder. Known as the Telestep, the unit is for the automatic remote control of municipal and industrial water and sewage treatment. Sample problems and solutions are given. Automatic Control Co.

208—Oil Filters

Oil filters for high flow rate filtration of internal combustion engine lubricating oil, using by-pass, shunt, or full-flow systems are described in four-page folder F-154. Phantom views show unit with and without heaters. Flow-pressure — viscosity data for various cartridges may be obtained from the graph in the bulletin. The Hilliard Corp.

209—Heating, Pumping, Straining

Oil heating, pumping, and straining units for stationary plants, built into a unit on one base pan or a series of base pans, are described in six-page catalog 9429. The different arrangements necessary to meet individual boiler plant requirements are discussed in detail along with illustrations. Combustion Equipment Div., Todd Shipyards Corp.

210—Flow Meters

Section on flow approximations and flow meter installation information makes 56-page catalog 2320 a valuable reference manual. It also describes all types of flow meters made by this company's Industrial Div., including indicating, recording, integrating, and controlling instruments of both evenly graduated and square root types. Minneapolis-Honeywell Co.

211—Valve Size Calculator

With this slide-chart calculator you can quickly estimate pressure drop and proper size steam valve needed for any pressure up to 1500 psi. Full operating instructions and necessary technical data are included. Golden-Anderson Valve Specialty Co.

212—Small Capacity Boilers

Small boilers available in 15 to 40 hp for heating and processing are introduced in four-page bulletin AD-134. Advantages such as the new hinged front and rear doors, forced draft air system, four-pass construction, and electric control panel are shown by means of drawings and photographs. Cleaver-Brooks Co.

213—Water Treatment System

"The Dorreo Aldrich PeriFilter System," six-page bulletin 9042, describes the physical characteristics, types, and sizes of this new water treatment system as well as its instrumentation, operation, applications, and advantages. The Dorr Co.

214—Material Handling Systems

"Engineered Materials Handling Systems," 32-page bulletin 400 describes and illustrates specific industrial examples of this company's material handling system. It gives technical information on an enclosed elevator for handling chemicals, and covers screw, vibrating, flight, slat, and belt conveyors, plus special purpose units. Gifford-Wood Co.

215—Liquid and Gas Control

Brought up to date and completely revised, 33-page bulletin 004 supersedes an earlier volume produced in 1950 on this company's equipment for the measurement and control of liquids and gases. Units described are applicable for water and sewage works, and power and processing industries. Simplex Valve and Meter Co.

216—Diatomite Filters

How filtration of water, or other liquids for industrial use, can be obtained simply, economically, and efficiently by means of this company's diatomite filters is described in Bulletin WC-115. Text, photographs, and schematic diagrams show typical arrangements of the unit. Graver Water Conditioning Co.

217—Roof Manual

"Solving Roof Problems," an absorbing and authoritative discussion of the subject, explores such subjects as the various types of roofs, how they are built, what factors enter into their deterioration, and how roof troubles can be diagnosed and treated. Tremco Mfg. Co.

218—Vari-Pressure Burners

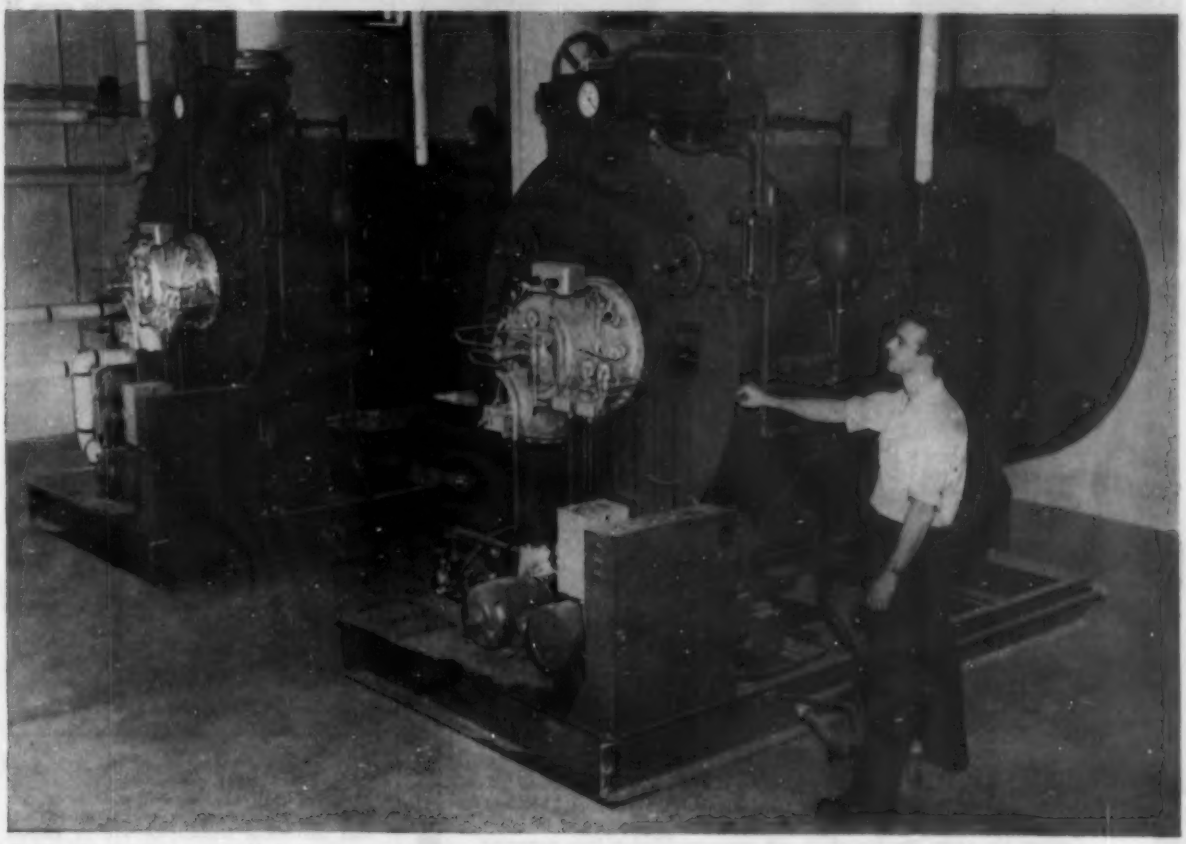
Design features developed in 55 years of progressive "oil burning know-how" are incorporated in the vari-pressure burners, Series 620-P, described in four-page catalog 413. Tables list sealed-in burner capacities without induced air and open firing burner capacities with induced air. Hauck Manufacturing Co.

219—Pipe Repairs

Catalog 54, 27-pages, is a valuable source book of information on the repair of all types of leaks in water, steam, gas, oil,

NOTE — Each new bulletin item has a key number for your convenience in asking for a free, personal copy. Circle key numbers on Reply Card between pages 36/37 & 92/93.

IN PUBLIC UTILITIES...



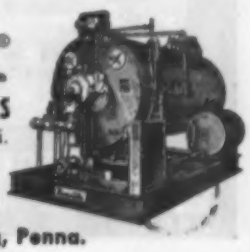
Powermaster® Save in Many Ways

For example: These two 125 HP *Powermaster* Packaged Automatic Boilers were recently installed to heat the garage and warehouse areas in Metropolitan Edison Company's new headquarters building, Reading, Pa. This electric utility also has a *Powermaster* unit for auxiliary service in one of its power stations.

Like all *Powermaster* boilers, these units excel in operating efficiency... the real pay-off in boilers. Other *Powermaster* advantages include: Cost-saving installation, space-saving compactness, fast steaming, high fuel economy at all loads, hospital-clean operation, dependable performance, maintenance-saving accessibility, fully automatic operating and safety controls, and smokeless combustion.

Compare now... and see why *Powermaster* is today's best buy in boilers for steam and hot water in industrial plants, all types of buildings, institutions, housing projects, schools and other requirements. Get the profitable facts on *Powermaster*. Write for latest descriptive bulletin.

O&S *Powermaster*®
PACKAGED AUTOMATIC BOILERS
In sizes to 500 HP; pressures to 250 psi.



ORR & SEMBOWER, INC. • Established 1885 • **Morgantown Road, Reading, Penna.**
Circle 525 on Reply Card for more data

LOW COST PROTECTION for EXPENSIVE EQUIPMENT

WA Standard with STEAM USERS SINCE '94

A modified investment in well engineered accessories will protect your major capital investment in power equipment. Wright Austin has served industry conscientiously for 60 years offering you the cost-saving and peace of mind that comes from knowing you're using proven designs.

Catalog 500 covers the line of separators, purifiers, exhaust heads for steam, air and gas.

SEPARATORS

Installation of the compact 31-N and other W-A separators and purifiers will guarantee freedom from damaging entrainment, oil, rust, scale and condensate in your power lines.

STEAM TRAPS

Operation of W-A traps is simple, fool-proof. Installation has been made easy and service can be performed with minimum effort and time.

Catalog 600 describes the wide range of W-A traps for steam, air and gas.

BOILER TRIM

Provisions for greater safety to equipment and worker plus peak efficiency is available at low cost in this line of 16 accessories.

Catalog 700 describes the complete line of alarms, gauges, controls, etc.

WRIGHT-AUSTIN COMPANY

3245 WIGHT STREET • DETROIT 7, MICH.

Circle 526 on Reply Card for more data

new bulletins

—Starts on page 38

ammonia, and brine lines. According to the booklet, pipe replacement, steam fitting labor, and operating shut-downs are eliminated in most instances by use of this company's line of pipe repair clamps. M. B. Skinner Co.

220—Proportioning Pumps

Design of the "K" pump, the result of long experience in the solution of proportioning problems, is shown in detail by means of a two-page foldout in five-page bulletin KP-54. Capacity and pressure tables will help you choose the pump for your particular requirements. Hills-McCanna Co.

221—Warm Air Unit Heaters

Two types of gas fired, warm air unit heaters are described in four-page folder 543-B; one for suspended mounting, and one that can be built into duct type heating or air conditioning systems. Tables list heating and air delivery capacities, outlet temperatures, air pressure drops, weights, and dimensions of the different units. Heating Dept. of Dravo Corp.

TO REQUEST FREE BULLETINS
Circle "key" numbers on Reply Card between pages 36/37 & 92/93. Your requests will be handled promptly.

222—Porcelain Enameling

A practical working knowledge of the latest developments in porcelain enamel and enameling techniques will be gained by reading 15-page handbook "Porcelain Enamel to Handle The Tough Jobs." Examples of uses such as for abrasive services, corrosion protection, and coating for handling sticky, viscous materials are shown. Erie Enameling Co.

223—Water Equipment Protection

"Laying-Up Equipment," six-page folder, cites examples, and suggests various methods used for protecting boilers, turbines, and other water using equipment during shut-downs. The booklet tells how this firm of consultants on water problems can help you protect your equipment against costly damage. Hall Laboratories, Inc.

224—Stepless Speed Control

Type VS Class 2 Gyrol Fluid Drive, described in four-page folder 9419, offers adjustable, stepless speed control for a wide variety of industrial applications. Components and operations are shown by means of cross-sectional drawing. American Blower Corp., Hydraulic Coupling Div.

225—Tank Cleaning

Chemical solvents provide many advantages in cleaning tanks of all sizes, shapes, and uses, according to this four-page pamphlet. How the cleaning service operates and what it can do for you is explained in text and photographs. Dowell Inc., subsidiary of The Dow Chemical Co.

226—Boiler Gaskets

Easy-reference flange gasket and boiler gasket dimension tables and bolting data are included in catalog AG-953. Shown are types for raised face, smooth face, crane-lap, and Van Stone joints, flange unions, male and female joints, and tongue

40 PAGES of helpful information

on Recovering Dusts, Fly Ash, Mists, Fumes and other Suspensions from Gases.

This booklet summarizes

the important points design and plant engineers should know about Cottrell Precipitators . . .

- Basic types of Cottrell equipment.
- Principal elements in a Cottrell unit.
- Data on Mechanical and Electronic Rectifiers.
- Various types of Collecting Electrodes (rod curtains, corrugated plates, pocket electrodes, etc.).
- Typical ways of removing collected material.
- Various Shell Constructions (steel, concrete, brick, etc.).
- The effect of various factors on efficiency and performance.
- Data on CMP (Combination Multiclone-Precipitator) Units.

. . . and many other helpful facts on Cottrell design and operation.

Latest data from Western Precipitation on Cottrell Recovery Equipment

Do you have operations in your plant where gas-laden suspensions, wet or dry, are a problem? Such suspensions may be dropping on surrounding property, causing nuisance difficulties. Or perhaps important values are being lost in stack gases that can be profitably recovered. Whatever the nature of your recovery requirements, you will find this 40-page Cottrell booklet of great help. It contains up-to-date data on the latest advancements in the electrical precipitation field – prepared by the organization that pioneered the commercial application of Cottrell Electrical Precipitators almost a half century ago and has consistently led in new Cottrell developments.

A copy of this data-packed booklet will be sent free to engineers and other executives interested in recovery processes. Send your request to our nearest office.

For nearly 50 years Western Precipitation has carried on a continuous research and development program on Cottrell Electrical Precipitators, Multiclone Mechanical Collectors and other types of recovery equipment. We are not affiliated with any other company in the electrical precipitation field except our wholly owned subsidiaries, International Precipitation Corporation and the Precipitation Company of Canada, Ltd. We are equipped to serve you anywhere in the United States, Canada, and throughout the world!

WESTERN Precipitation CORPORATION

DESIGNERS AND MANUFACTURERS OF EQUIPMENT FOR COLLECTION OF SUSPENDED MATERIALS FROM GASES & LIQUIDS

Main Offices: 1057 WEST NINTH STREET, LOS ANGELES 15, CALIFORNIA
CHRYSLER BLDG., NEW YORK 17 • 1 N. La SALLE ST. BLDG., CHICAGO 2
1429 PEACHTREE ST. N.E., ATLANTA 5 • HOBART BLDG., SAN FRANCISCO 4
PRECIPITATION CO. OF CANADA, LTD., DOMINION SQ. BLDG., MONTREAL

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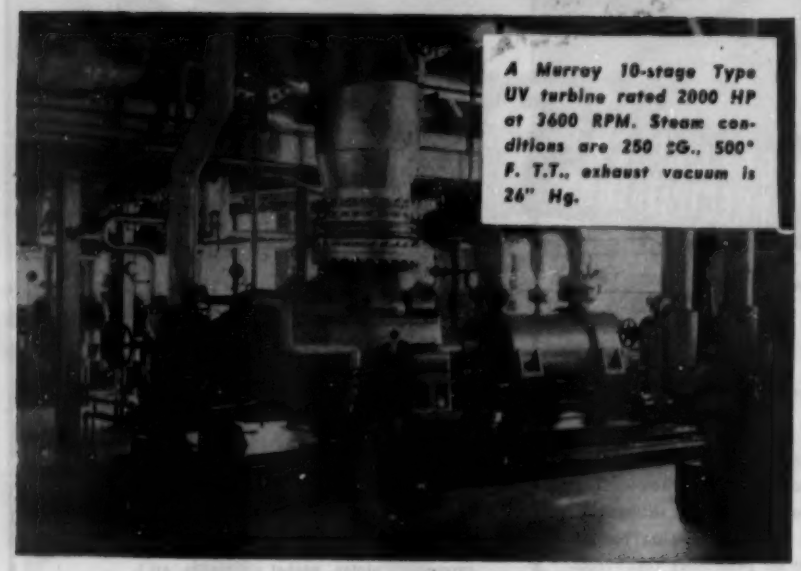
Murray Turbines



A Murray 10-stage Type UV turbine rated 2000 HP at 3600 RPM. Steam conditions are 250 #G., 500° F. T.T., exhaust vacuum is 26" Hg.

● The Murray Type UV turbine pictured above has been driving a high pressure lean oil pump in a Southwestern refinery for the past 10 years and is still giving dependable, trouble-free service.

Murray mechanical drive turbines both single and multi-stage can be furnished in a wide range of ratings for steam pressures ranging from 0 to 600 #G., condensing and non-condensing. Types in the higher pressures available for up to 250 #G. back pressure.

MURRAY IRON WORKS COMPANY
BURLINGTON, IOWA

BUILDERS OF STEAM POWER EQUIPMENT FOR THREE QUARTERS OF A CENTURY

Circle 528 on Reply Card for more data

new bulletins

—Starts on page 39

and groove fittings for all standard makes of boilers. United States Gasket Co.

227—Gage Catalog

The four important questions to ask before you buy gages are listed in comprehensive 68-page catalog 64. Whether you need gages for replacement on operating equipment or for installation on new equipment, you will find complete information with drawings and specifications in this booklet. United States Gauge Div., American Machine and Metals Inc.

228—Turbine Speed Control

"Fundamentals of Turbine Speed Control," 32-page brochure H-21, is an educational piece intended to clarify the operation of common types of automatic speed control for steam turbines. Simplified diagrams illustrate operating principles of actual control systems. Elliott Co.

229—Steam Trap Problems

"Solving Steam Trap Problems," revised 36-page catalog T-5M254, includes information on the new combination float and thermostatic traps, which vent air in one-eighth the time of standard inverted bucket traps. The booklet also tells how to calculate condensation loads and select traps. V. D. Anderson Co.

230—Transmission Line Corrosion

"Corrosion Control of Electrical Structures and Equipment," 17-pages, is designed to give the field operating men of electric light and power companies practical painting information on all phases of transmission and distribution work. Photographs are used to show the protection that can be expected from this company's paint products. Subox, Inc.

231—Heated and Cooled Gages

Four-page data unit 237 covers special purpose heated and cooled gages and valves which are said to solve the problem of getting accurate level readings of liquids that boil or surge — or liquids that are heavy and don't flow at normal temperature. Cross sections and drawings show design and construction. Jerguson Gage & Valve Co.

232—Feedwater Alkalinity

"Experiences with Filming Amines in Control of Condensate Line Corrosion," technical paper 127 attributes condensate line corrosion chiefly to the presence of carbon dioxide in the steam and water. Various methods of minimizing boiler feedwater alkalinity are discussed, especially the employment of filming amines. W. H. & L. D. Betz Co.

(Continued on page 84)

STRENGTH

for Safety and Long-Time Service

For 2000, 3000 and 6000 pounds service — Sizes 1/8" to 6"

SCREW END TYPE

For schedules 40, 80 and 160 pipe — Sizes 1/8" to 4"

SOCKET WELD TYPE

Vogt Ells, Tees, Crosses, etc., are forged from carbon steel or various alloys to meet specific operating conditions. Catalog F-9 will aid you in their selection and proper application.

Shocks and stresses imposed by high pressures and high temperatures are taken in their stride because Vogt fittings are uniform in structure, fine grained, and free from porosity . . . the superior product of laboratory controlled materials and giant forging hammers and upsetters. These properties also give higher resistance to erosive and corrosive conditions, thereby adding to service life expectancy in steam plants, petroleum refineries, chemical plants and related industries.

HENRY VOGT MACHINE CO., INC.
Louisville 10, Kentucky
BRANCH OFFICES: NEW YORK • PHILADELPHIA • CLEVELAND • CHICAGO • DALLAS

Vogt

DROP FORGED STEEL FITTINGS

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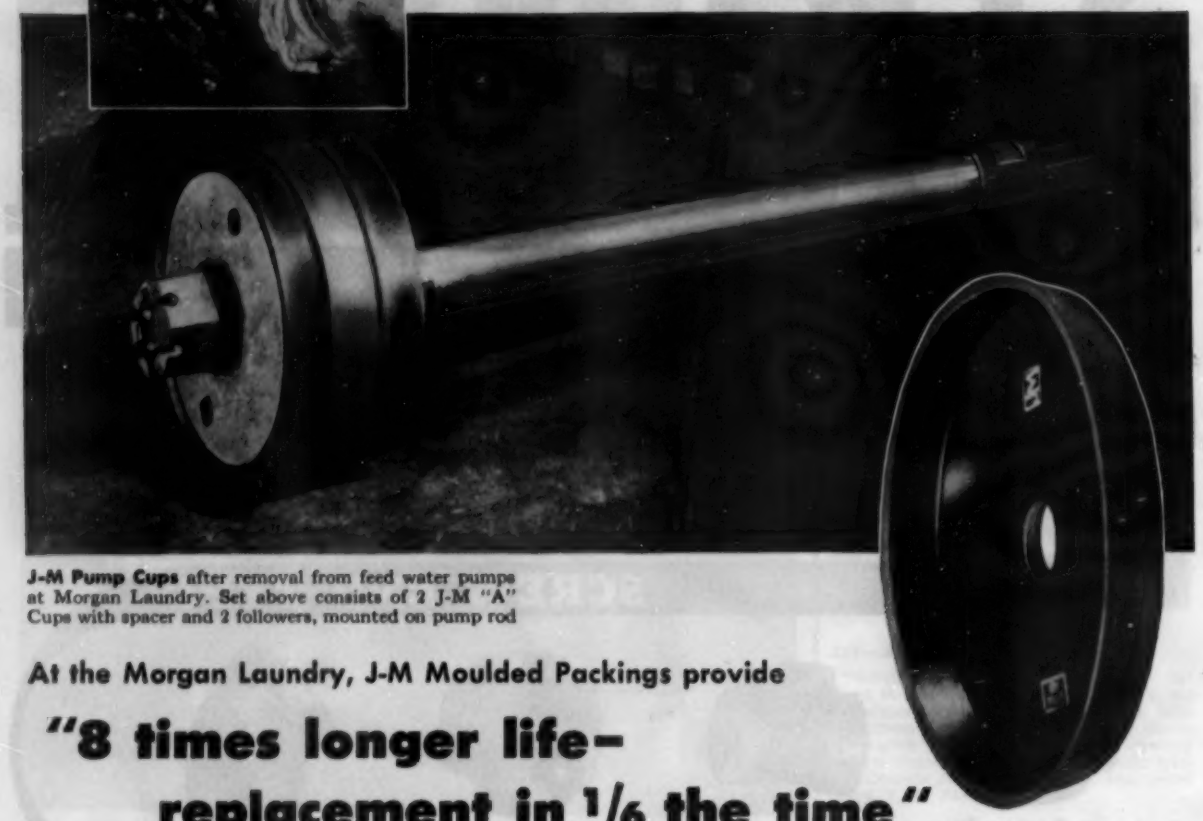
Trying to reduce piston packing maintenance?



J-M Pump Cups after removal from feed water pumps at Morgan Laundry. Set above consists of 2 J-M "A" Cups with spacer and 2 followers, mounted on pump rod

At the Morgan Laundry, J-M Moulded Packings provide

"8 times longer life— replacement in 1/6 the time"

THE MORGAN LAUNDRY, large supplier to hotels and institutions, requires dependable, trouble-free service from boiler room equipment. In their New York City plant, the Engineering Department found that conventional piston packings for boiler water feed pumps lasted only a relatively short time. Many hours of down time were required to replace packings. Liner wear became progressively worse.

When the Engineering Department changed from the conventional material to J-M Moulded Packing Cups, service life of the packing was increased more than 8 times. Liner wear was greatly reduced. Replacement with the new packings was made in 1/6 the time. Packings could be easily installed for proper service, without special skill or experience. Satisfaction with this application has led to the use of J-M Moulded Packing Cups on other boiler room equipment and on presses in the Morgan Laundry plant.

These precision moulded packings offer definite advantages over conventional types. Because they form a highly efficient seal, they contribute to improved performance, lower operating and maintenance costs. For steam pump pistons, they are available in sets consisting of two cups and two followers, with a spacer. This pump cup set, J-M Style 80, is similar to that shown in the illustration above.

Your Johns-Manville Packings Distributor can help you make the right selection for your application, from Johns-Manville's line of custom-made Piston Packing Cups. For complete details write him or Johns-Manville, Box 60, New York City 16. In Canada, 199 Bay Street, Toronto 1, Ontario.

Johns-Manville PACKINGS & GASKETS

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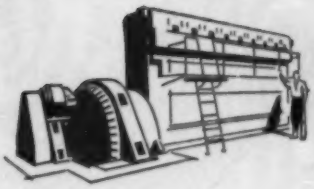


"Cured... bearing failure in their diesel-driven, front-end loaders"

A large fire-brick manufacturing company in the Philadelphia area had the problem of premature bearing failure in its diesel-driven loaders and shovel.

Headlights on even in daylight...

Sinclair Lubrication Engineer Harry Donovan reports, "These units were operating around the clock under conditions *so dusty that headlights were required.* Crankcases had to be drained and flushed bi-weekly! My first recommendation was closer adherence to an air filter maintenance program."

Drain intervals doubled!

Mr. Donovan continues, "Further observation proved to me that excessive idling and overloading were all contributing factors to a severe sludge condition. I recommended Sinclair SUPER TENOL® — explaining that the superior quality of the base oil plus the Sinclair formulated additives would extend bearing life *while at the same time removing accumulated lacquer and sludge.* A trial period proved SUPER TENOL doubled drain intervals and eliminated flushing entirely. This company now uses Sinclair SUPER TENOL exclusively."

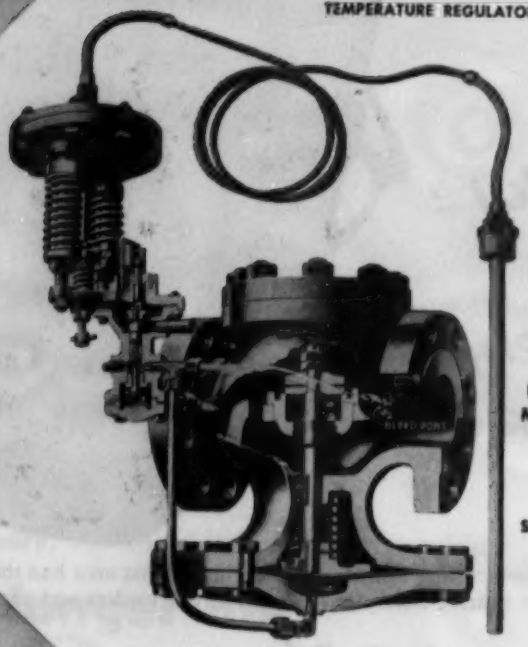
Why not give a Sinclair Lubrication Engineer the chance to solve *your* lubrication problems? *There's no obligation.* Contact your local Sinclair office or write Sinclair Refining Company, 600 Fifth Avenue, New York 20, N. Y

SINCLAIR LUBRICANTS

Circle 531 on Reply Card for more data

3 Reasons for Accurate Regulation

SPENCE TYPE ET150
TEMPERATURE REGULATOR



PACKLESS CONSTRUCTION

LARGE BALANCED METAL DIAPHRAGM

SENSITIVE PILOT

Spence

Packless construction eliminates the need for closely fitted parts that may stick or bind due to dirt or uneven expansion of the parts.

In Spence Temperature Regulators, the Main Valve is actuated by a large balanced metal diaphragm which responds to the slightest changes in temperature.

Sensitive Pilots are designed to limit heater pressure to an adjustable maximum. As the temperature at the thermostat drops a few degrees there is a corresponding increase in steam pressure up to the limit for which the Pilot is set.

With regulators that respond only to temperature, an increase in load is accompanied by a momentary decrease in steam pressure caused by faster condensation in the heating element. There is a time lag until the thermostat senses the temperature drop and opens the valve wider. Spence Temperature Regulators act like pilot operated pressure regulators when this occurs. They respond instantly to maintain the steam pressure until the thermostat has a chance to further increase it as needed for the heavier load.

These plus other design features explain why Spence Temperature Regulators function dependably and accurately year after year, without requiring extensive repairs or special attention.

Want more facts? Write for Bulletin T50 giving full details.

8K150

SPENCE ENGINEERING COMPANY, INC., Walden, New York

Circle 532 on Reply Card for more data

NEW "Small" boiler is a Big Quality package!

Available up to 80 hp — heating or processing — steam or hot water. A complete unit from a single source.

CLEAVER-BROOKS modern CB boiler

NO BOILER HAS EVER OFFERED SO MANY ADVANTAGES AND QUALITY FEATURES AT SUCH LOW INITIAL COST

• This NEW CB boiler has EVERYTHING needed to bring *big boiler standards* to commercial, industrial and institutional users with small capacity requirements. Despite its unusual, compact size you get big boiler performance — from matched-quality components, proved the world over on thousands of Cleaver-Brooks self-contained units.

Get all the facts NOW on how the new CB can help you save dollars. Make it a point to see . . . and *hear* the most silent-running, biggest boiler value available anywhere!

•

Call your nearest CB boiler representative (see your phone directory) or send for this illustrated catalog describing the NEW CB — designed by Cleaver-Brooks, originators of self-contained boilers.

gives you all the quality features of time-tested self-contained design

- **FOUR-PASS FIRETUBE CONSTRUCTION** — longer gas travel scrubs heat from flame — means lower fuel costs — guaranteed efficiency of 80% when firing with oil.
- **SILENT OPERATION** — even at peak load this boiler more than meets the low sound levels required for schools, hospitals, institutions.
- **FULL FIVE SQUARE FEET** — of heating surface per boiler hp — for longer service life and low maintenance.
- **FUEL FLEXIBILITY** — burns available light oil, gas, or combination oil/gas — simple, quick fuel changeover on oil/gas models.
- **FAST, EASY MAINTENANCE** — front and rear doors hinged for fast inspection, cleaning or servicing boiler.
- **AUTOMATIC SAFE OPERATION** — all controls centralized and conveniently located — modern electronic combustion control is standard equipment.
- **COOLER BOILER ROOM** — fiber glass blanket insulation and 16 gauge metal sectional lagging are non-corrosive, moisture and heat resistant.
- **FULLY APPROVED** — by Underwriter Laboratories; conforms to ASME codes; factory tested before shipment.

Cleaver Brooks

Cleaver-Brooks Company, Dept. H, 302 E. Keefe Ave., Milwaukee 12, Wisconsin, U.S.A.
Cable Address: CLEBRO — Milwaukee — All Codes.

Originators of the Self-Contained Boiler

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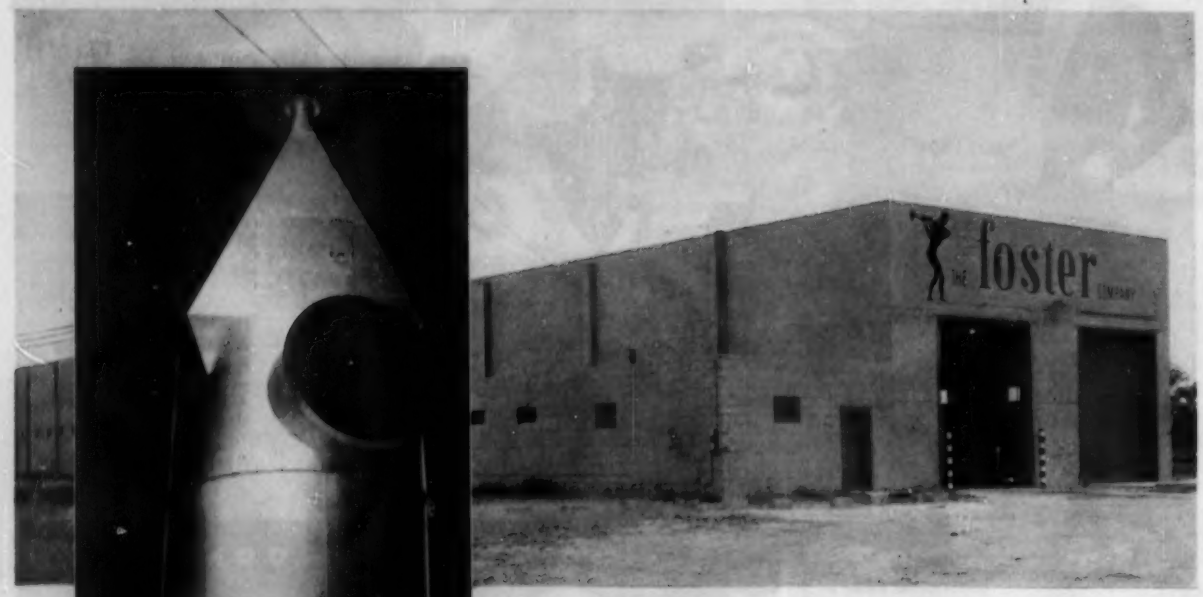
AFTER-COOLER FOR NEW DETROIT FOUNDRY



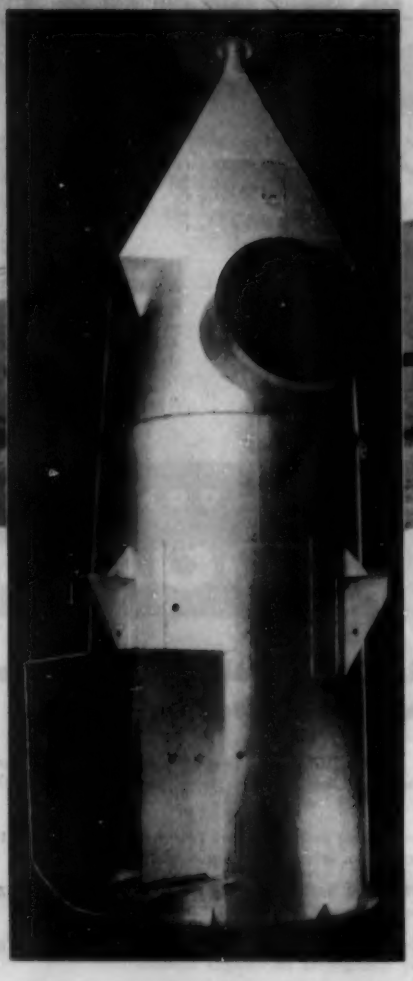


Photo at left shows one of two cooling chambers, integral components of vortex type dust collectors. Special design by Grindle Corporation eliminates dust, fumes, general smoke nuisance from expanded cupolas and stacks of major Detroit automobile manufacturer.

After-cooler pictured above is typical of heavy *precision* weldments manufactured by Foster. New building has heavy duty over head crane facilities; houses new equipment for shearing, burning, bending, braking, forming, annealing, sand-blasting.

Raw materials from nearby Gary-Chicago mills; deliveries by motor freight, railroads, barges via Illinois and St. Lawrence Waterways.

Tho costs are moderate, fine quality and agreed delivery are sole standard at Fosters.

THE **foster** COMPANY ST. JOSEPH, MICHIGAN

Circle 534 on Reply Card for more data

Floorstand equipped with Motor Unit . . . control panel, motor, limit switch and push button station.

Simple and RUGGED...

CHAPMAN'S MOTOR UNIT

for Valves, Floorstands and Sluice Gates

Simple, durable mechanism of Chapman's Motor Unit. Handwheel remains stationary during motor operation.

Chapman Motor Units have fewer components than any other units, providing greater dependability, much lower maintenance costs.

There are only two pinions and two gears in the motor reduction train: drift is eliminated and lash is negligible. Your valves seat tight, but not too tight. Operation is *always* smooth and trouble-free.

You can mount the Chapman Motor Unit in any position, at any angle required. The rugged stub-tooth gears require no grease or oil bath . . . yet run smoothly, quietly, with minimum wear.

Weatherproof and steam tight, Chapman's floorstand units are shipped completely wired, ready to connect to your power leads, for easy, rapid installation. This modern motor unit is dependable and economical. Send for *new* catalog No. 51.

The CHAPMAN Valve Manufacturing Company

INDIAN ORCHARD, MASSACHUSETTS

Circle 535 on Reply Card for more data

3-way answer

to steam trap problems

• This three-way combination can help lick your steam trap problems.

YARWAY IMPULSE STEAM TRAP . . .
the steam trap that gets equipment *hot in a hurry and keeps it hot.* Small size, light weight, *body and all working parts of stainless steel.* Low cost, low maintenance.

YARWAY FINE SCREEN STRAINER . . .
with high-grade woven Monel wire screen that is removed with the cap for easy cleaning. Rust-proof finish . . . straight threads, machined faces and spark-plug type gaskets on screen caps.

YARWAY ENGINEERING SERVICE . . .
32 trained YARWAY engineers working out of YARWAY branch offices from coast-to-coast, are constantly helping on *trap selection, installation maintenance* and *operation.* Solving your trap problems is their job. It will cost you nothing to call them in to assist you.

YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Pa.

• YARWAY IMPULSE STEAM TRAPS AND STRAINERS are immediately available from more than 250 Industrial Distributors in the United States, Canada, and other countries. For name of one nearest you and FREE Steam Trap Bulletin write . . .

YARWAY

impulse steam traps

And Yarway Fine Screen Strainers

Circle 536 on Reply Card for more data

Typical fin tube radiators, stacked four rows high between columns along the outside walls, heat the new Buick plant.

Hot Water Heating at Buick

The consulting engineer felt that he gave the owners exactly what they primarily wanted—heating with a minimum of maintenance—when he designed this hot water system.

G. S. WHITTAKER, Associate
Albert Kahn Associated Architects & Engineers

WHEN THE HEATING system for the new Buick Motor Division plant was under discussion with the owners, one of their first requests was for a system which would require as little maintenance as possible. The owners wanted to reduce to a minimum the servicing of traps, unit heater motors and starters, and similar maintenance items that might occur.

Preliminary Considerations

These initial requirements ruled out a unit heater system using medium pressure steam distribution. A hot blast system had similar disadvantages—also, ducts in a hot blast system would interfere with other equipment being installed in the plant.

After preliminary discussion and consideration of alternate methods, a forced hot water system was decided upon. This type of system requires a minimum of maintenance and has a very long span of useful life—the water is continually recirculated in the system and is never changed or drained (unless absolutely necessary). A small amount of water is added only to replace any slight leakage (such as drippage from the glands in the circulating pumps) as may occasionally happen.

Once the specific type of system was selected, the next step was to design one which would keep the cost to a reasonable figure, allow flexibility of operation, and provide an even distribution of heat. The final design incorporated the reversed return type with the factory portion—in general—heated by means of overhead coils in the roof trusses and radiation along the outside walls. The mains were run well above the bottom chord of the roof trusses leaving the area below clear for manufacturing purposes.

Physically, the building is approximately 1100-ft long and 700-ft wide with an over-all average height of 25 feet. The floor space is equivalent to about 22 acres.

The building curtain walls are of concrete, 8-in. thick and 8-ft high, with steel sash windows and 2-in. gunite walls above. The roof is of monitor sawtooth construction. The monitors run east and west across the building with windows in the north side and pre-cast tile with insulation and five-ply roofing overhead.

On the east side—which is somewhat higher than the main part of the building—is the shipping and receiving area. A mezzanine section runs across the center of the building and houses the offices, locker rooms, cafeteria, kitchen, and storage areas. The plant structure was well-suited for the proposed heat-

ing system layout and design.

Distribution Lines

The 14-in. main hot water service lines enter the building at the south end of the structure. From here, they are distributed to the various parts of the building. The supply and return headers are split into two systems at this point. One runs around the outside walls in the roof trusses and serves the radiation under the windows. The other system, running north and south along the west side of the high shipping and receiving bays, serves the overhead pipe coils in the roof trusses of the building.

Equalizing Heat

Since the mains entered at the south end of the building, it was possible to take advantage of a natural feature of the structure in planning the system. The building pitches up from south to north approximately 36 inches, and as the mains pitch up in the same direction, the contractor's work in locating pipes and determining hanger lengths was simplified.

Every 40-ft wide monitor bay running across the main section of the building has six wrought iron pipe coil units, each of which contains three 2-in. pipes with harps at the ends. To supply these coils, a valved connection is made from the supply head to coil #1 at the east end; the water is pumped through the coil to the west end and through a pipe connection to the west end of coil #2. The water then passes through this coil back to the east end where it is fed to the main return header through another valved pipe connection.

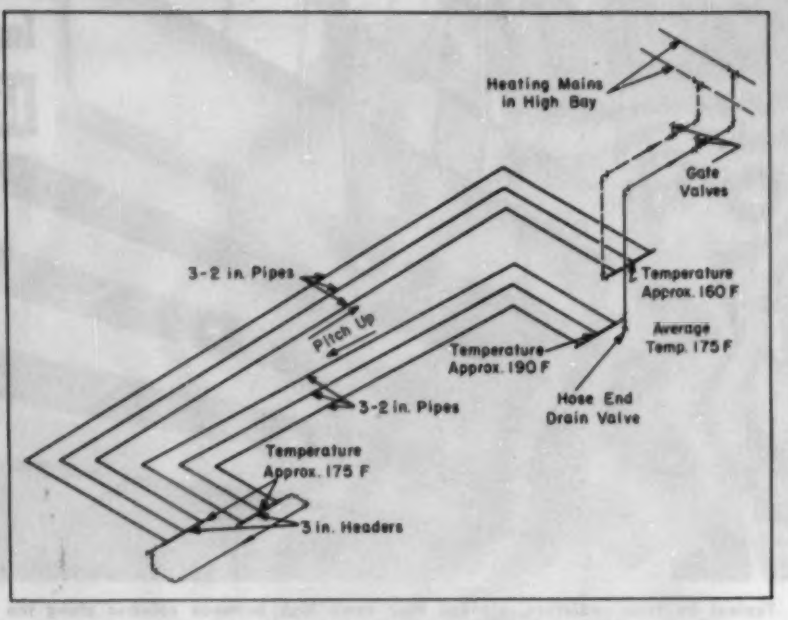


Fig. 1—The schematic shows how the hot and cold ends of two coils are connected together so that an even heat is maintained throughout the coils.

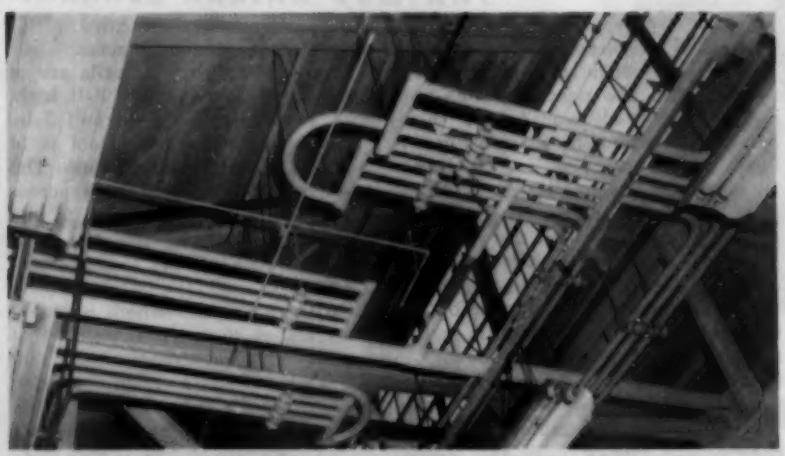
By connecting the coils in this manner, an even heat is maintained throughout the coil—as the hot and cold ends of the two coils are together and the opposite ends have the same mean temperature. To illustrate, suppose the supply end of coil #1 is supplied with water at 190 F and the system is designed for a 30 F drop through the coil. This arrangement gives a 160 F temperature at the return end of the coil or an average temperature of 175 F for the two coils. The opposite ends of the coils will have a temperature of 190 minus 15 (half the temperature drop) or 175 F.

The shipping and receiving bays at the east side of the building have overhead coils of the same type as the east and west monitor bays. However, the latter run in a north and south direction due to the construction of the roof monitors in this area. They are supplied from the main lines along the west side of the high bay in the same manner as the coils in the low bays. These coils are flexible in relation to building changes. If an overhead toilet or a transformer room addition is made in the section of the trusses where the coil is located, it is only necessary to cut a piece of the coil out, add a harp with a header at each end, and connect them with the proper size piping.

No Branch Mains

By running the coils in this manner, supply and return mains are required only in the center of the building—instead of a whole series of branch mains throughout the trusses. An outline of the basic system is shown in Fig. 2. With the mains supplying these coils located in the higher trusses, the coils all vent the air back to the mains and air traps are required only at the ends of the mains and the long coils.

The fin tube radiators, stacked four rows high between the columns along the outside walls, are 2-in. steel pipe with 4¼-in. fins in lengths averaging 16 feet. In some areas, where more radiation is re-



One advantage of locating the heating coils in the trusses (overhead) is to give the system greater flexibility in relation to any future building changes.

quired, this radiation is eight pipes high in two sections of four pipes. A sheet metal deflector is placed between each section of four rows to insure that the group emits heat to the best possible advantage. Along railroad bays and near large doors, the radiation is of the cast iron wall type, in place of the fin tube, two tiers high, in order to get a larger amount of square feet of radiation with more prime surface in a given area. Also, the overhead toilet rooms and transformer rooms are heated by cast iron wall radiators which are supplied with connections from the pipe coils below. These radiators, being above the mains, require automatic air traps.

All the radiation, except as noted above, is supplied by down feed risers connected to the overhead distribution mains through gate valves. These risers are taken from the bottom of the mains in order to eliminate any necessity for air traps on the radiators or risers. The mains are installed with eccentric couplings wherever a reduction in pipe size occurs. This allows any entrained air to flow along the top of the mains to the end of the lines to be eliminated through large automatic air traps.

System Balance

There are no balancing ells or throttle valves indicated or used in this system as considerable care was taken to balance the system with the piping. Although imposing extra care and work on the part of the designing engineer, it will function better than a similar system using a large number of throttling devices. The problem of the maintenance men, by opening and closing the valves, continually upsetting the balance is eliminated with the designed system.

Heating Load

The total heating load supplied by the coils and the various types of radiation is approximately 54 million Btu per hour or some 3650 gpm of hot water at a 30 F drop in temperature. To take care of radiation losses in the main grid system, 10 percent was added to this figure, bringing the design requirement for the size of the equipment needed to supply the heating system to 4000 gpm at maximum.

The water heating and pumping equipment is housed in a small powerhouse approximately 600 feet south of the main plant. The main hot water service lines, as well as the owner's process steam, pump discharge, and air lines, are carried on a conveyor bridge across a public thoroughfare to the south end of the new building.

The bridge, interestingly enough, was fabricated on the ground in sections and all the piping installed before each section was hoisted into place. The only installation required at the high elevation was the welding of the sections and the final end connections. This method saved time and labor for the contractor.

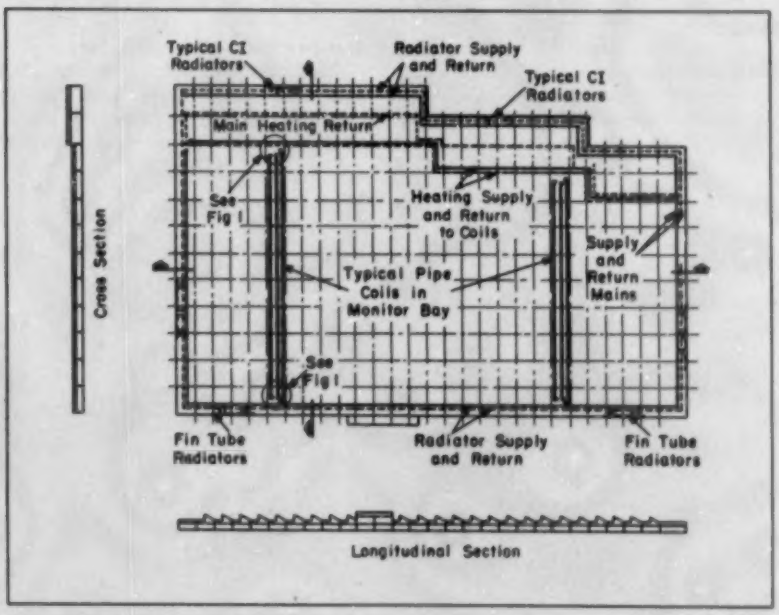


Fig. 2—Instead of using a whole series of branch mains in the trusses, supply and return mains are required only in the center of the building.

Equipment

The equipment installed in the power house for this system included two vertical type heat exchangers, two circulating pumps—one of which is electric driven and one turbine driven. The vertical heaters are of the shell and tube type with multiheads, each having a capacity to heat 4000 gpm from 175 to 205 F when supplied with steam at 7 psig.

The electric circulating pump is of the horizontal split case type, single stage, double suction, with a capacity of 4000 gpm against a head of 150 feet. The turbine driven pump is the same type and capacity as the electric unit. The turbine is a single stage type operating at a maximum speed of 1750 rpm with an inlet pressure of 125 psig and a back pressure of 7 psig. This pump is controlled by an adjustable speed governor and the electric unit by an automatic across-the-line starter.

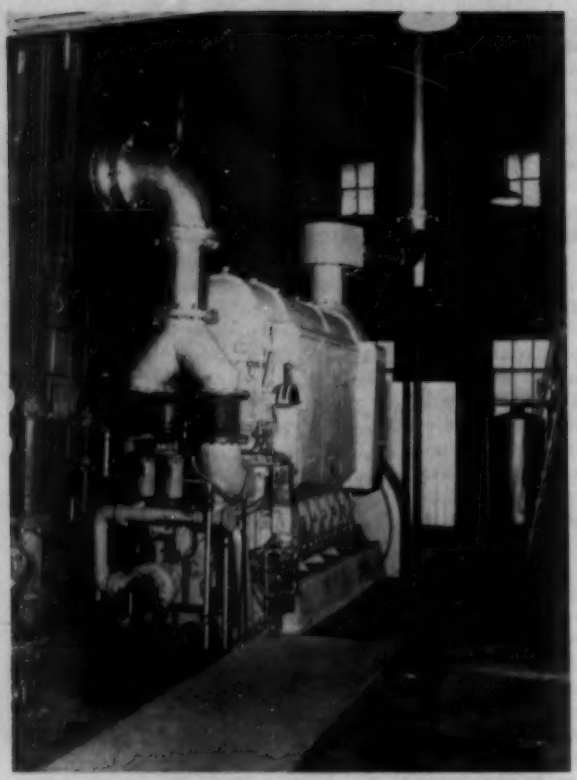
The primary steam supply for the heat exchangers is the 7 psig exhaust steam from the steam driven air compressors, the steam driven condensate pumps, and turbine hot water circulating pump. If these units cannot supply sufficient steam for the heaters, there is an automatic makeup valve connected to the high pressure line through a pressure regulating station which automatically cuts in if the low pressure steam drops below 5 psig.

Controls

The required water temperature leaving the heat exchangers is controlled by means of pneumatically actuated valves on the 7-psig steam line to each heater. These valves are adjusted by the operator on duty using graduated control equipment. The operator varies the water temperature according to a chart which shows the water temperatures required for various outside temperatures.

Condensate from the heat exchangers runs through 17½-ft deep water seals in place of traps before discharging into the condensate receiver. From this receiver, the condensate is pumped back to the feedwater heaters.

Because this type of heating system does not require that the main hot water heating distribution lines, risers, radiator connections, in the main building be covered, another, considerable saving was effected.



An opposed-piston type F-M engine driving a 675 kw generator is the latest addition at the Girard station.

Oil reclaimers are an integral part of this borough-owned diesel plant where economy is of prime concern.

Small Town Diesel Plant

WALTER RUDOLPH

AT THE TURN of the century, Girard, Pennsylvania, was a quiet, rural community of something over 1000 population—well-balanced, with a few woodworking and other plants, and its share of supply houses for surrounding farms. Since the area was not supplied with natural gas, a steam power plant, with necessary distribution system, was erected early in 1900.

The steam plant sufficed until 1916, when it was declared obsolete and operation was discontinued. However, by that time, Pennsylvania Electric was rapidly assuming the proportions of a big utility in northwestern parts of the state and it was comparatively simple to buy wholesale power.

A switchboard was set up in the old steam plant and Pennelec (as the utility is known) supplied power to the Girard lines. The utility wanted to buy the lines and tie them into its own system, but members of the borough council deferred making any final decision. In fact, two decades passed before the choice was made to invest borough capital (raised through a bond issue) in a diesel plant to generate power for the community requirements.

The old steam plant was converted and two Fairbanks-Morse, 200-hp engines with 3-phase, 60-cycle, 2400-volt generators were installed

Plant has expanded several times since the first diesel was installed in 1936.

for an initial total capacity of 400 kw. Owning its own plant proved to be an efficient and profitable operation for the borough. A third F-M unit was added in 1938 to meet the growing demand for power.

Since 1938, four additional engines have been installed. The latest, a 960-hp, F-M, opposed piston type unit, generating 675 kw was put on the line early in 1952.

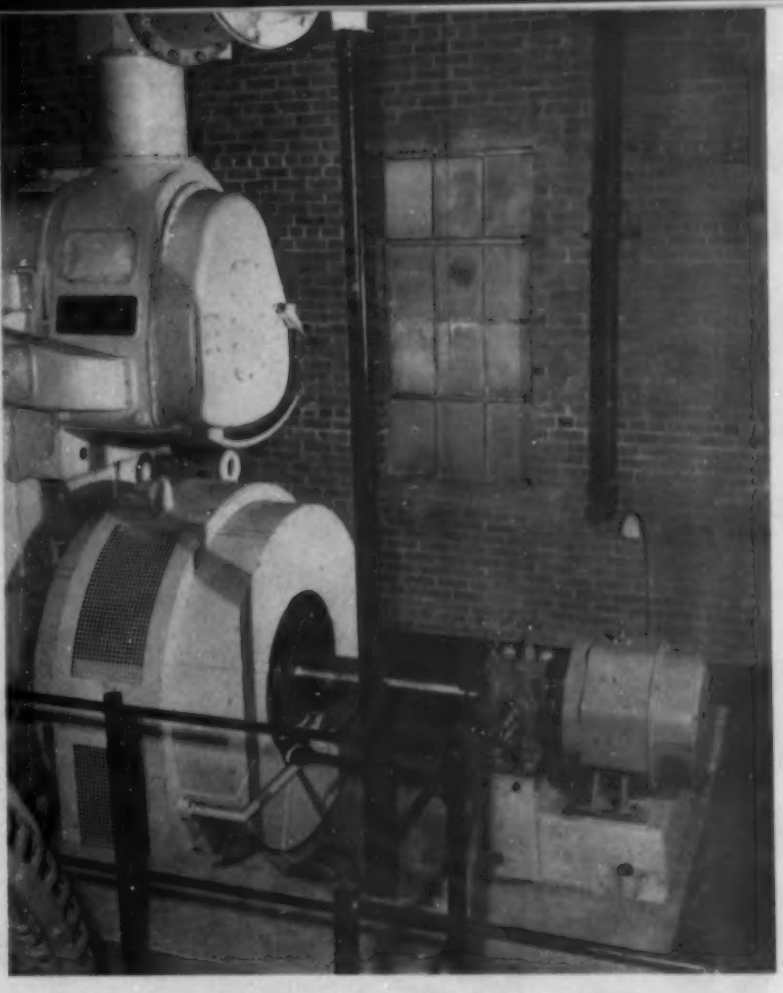
Paying Its Way

Girard has learned a great deal about running a diesel power plant in the past years. The city is making enough money on the power plant (and on water revenue) to keep up with modern trends in roads, fire department, and police equipment.

The following tabulation gives some indication of the rapid growth in total kilowatt consumption which has taken place over a comparatively short period of years:

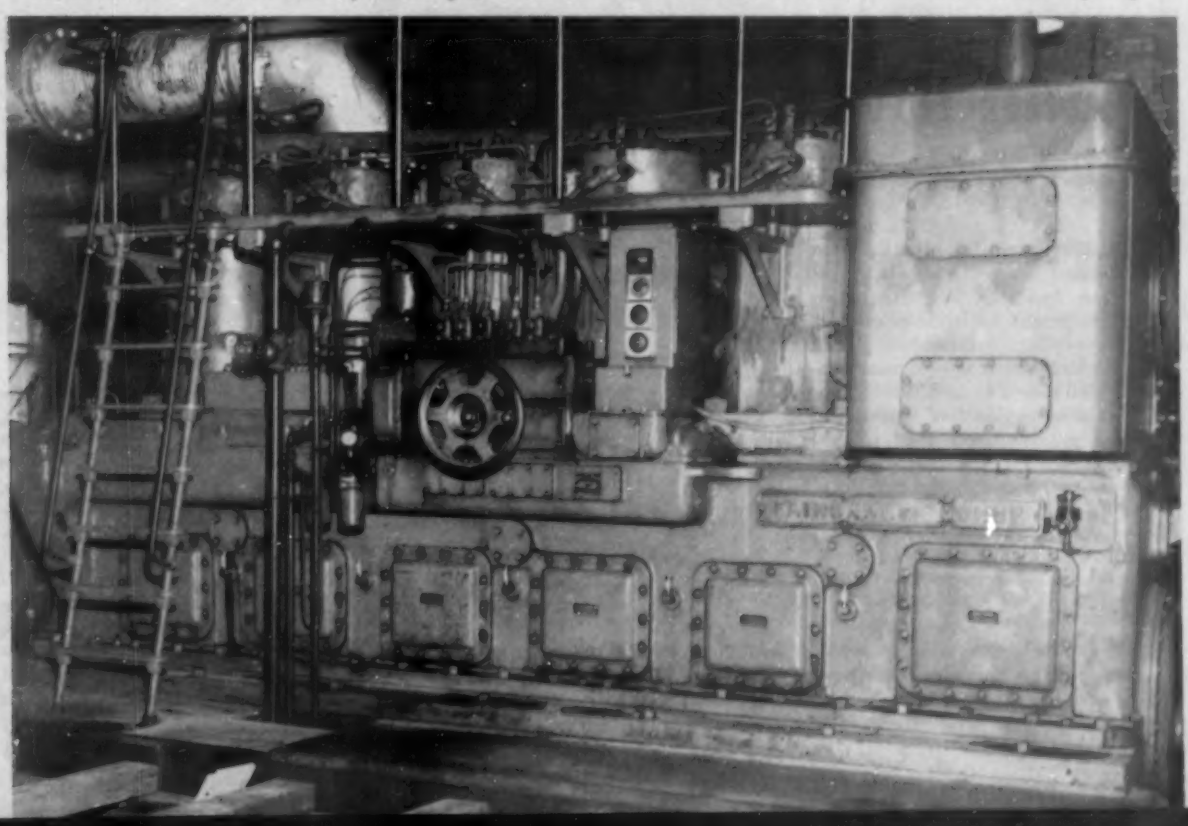
1938	1,464,410 kwh
1940	1,873,986 kwh
1942	2,109,030 kwh
1944	2,231,405 kwh
1946	3,012,920 kwh
1948	3,834,820 kwh
1950	5,103,833 kwh

It is interesting to note the success and economy with which this power demand is being met by the Girard diesel plant in the face of competition by the larger utility system.



A close-up view of the generator and exciter showing coupling arrangement.

Between 1938-50 total kw consumption has grown from 1.5 to over 5 million. New unit will further increase capacity.



Isotope Products Ltd.

Introducing sodium-24 into piping system to test for leaks. Detecting instrument is used to check level of exposure.

Handling Radioactive Isotopes

LEO WALTER, Consulting Engineer

OVER 350 industrial plants in the United States, and about 100 Canadian factories, are using isotope equipment or radiography in their everyday operations, thus showing that the fear of contamination, which seems to be hindering the wider use of radioactive substances, is entirely unfounded. Modern isotope instruments are manufactured to operate as reliably as any other piece of industrial equipment, and the producers of isotopes for industry furnish full instructions regarding their use.

Basic Facts

Each of the three basic forms of radiation, alpha particles, beta particles, and gamma rays, cause electrons to be separated from the atoms of material, thus leaving positively charged ions behind. This ionization provides a means of detecting radiation and of safely handling radioactive materials, the best known detecting instruments being the Geiger-Muller counter and the scintillation counter.

Industrial application of radioactivity is based on the ability of radioactive rays to penetrate opaque materials. The simplest and oldest application of this is X-ray photography, but X-rays are limited because they lack penetration. Radium, as a natural isotope, provides a source of rays that can penetrate metal more readily than X-rays, but it is very expensive and requires long periods of time to penetrate some materials.

Artificial isotopes, made by placing an element in an atomic pile and bombarding it with neutrons, are more suitable in industrial applications. The most commonly used artificial isotope is cobalt-60, which

does not have as much depth penetrating power as radium, but does provide faster penetration and costs much less. Others, such as uranium-192, used for radiographing welds and medium to light castings, and sodium-24, are being used for specialized applications.

Factors Determining Use

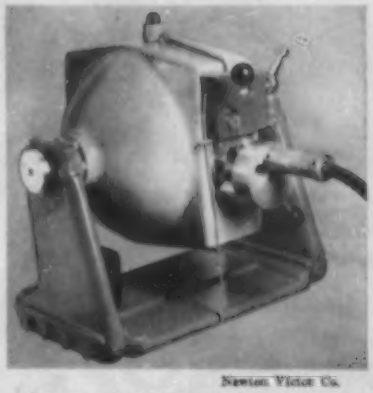
Three basic factors are considered in determining the suitability of an isotope for a particular industrial application. The first consideration is penetration, which varies with different isotopes. The isotope's half-life, which is the measure of the expenditure of its radioactivity, is another factor to be investigated. The half-life may be too short to be practical, or it may require too long a bombardment period in the atomic pile, since elements with a long half-life require longer bombardment periods.

Availability of the material which is to be made radioactive is a third consideration. Some isotopes, such as sodium-24, can be made by processing common table salt in an atomic pile, while others require the use of scarce materials. At present, about 60 to 70 useful isotopes are known; however, engineers are using only eight or ten of them for industrial applications.

Health Hazards

Care must be taken in handling isotopes because of the electrons and gamma rays which they emit. They do not, however, emit neutrons as do atomic piles. Neutrons are not only lethal, but induce radioactivity in the things they contact, thus contaminating metals, earth, and water by making them radioactive. The gamma rays emitted by isotopes also are lethal, but are not retained by the media they contact or pass through. The electrons, or beta rays, are not lethal, but can burn the skin.

Facilities for the safe handling of industrial isotopes vary widely with the type of material and its specific application. For example, where a paper mill measures thickness by using a betameter containing 30 millicuries of thallium-204, the only safety requirement is to read carefully an instruction leaflet supplied with the instrument. Here, the radioactive source is sealed to a backing plate and is safely enclosed in two firmly secured metal foil covers.



Newton Victor Co.

Container for handling 1 curie of cobalt-60 features remote control.

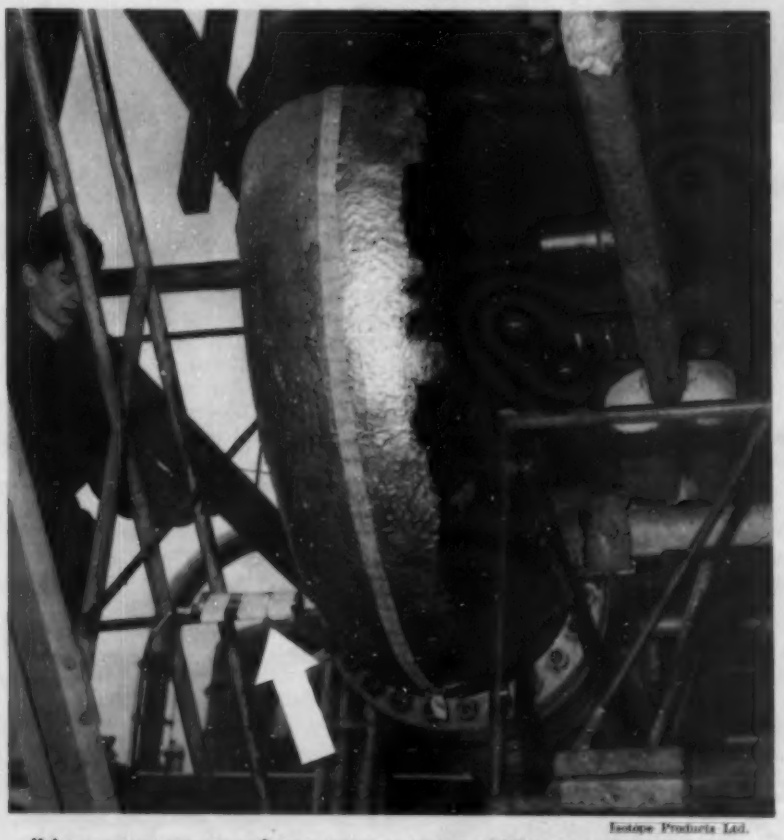
The beta radiation is released from the source in only one direction, and is beamed at the detection head. Thus, hazardous stray radiation does not occur around the instrument, and virtually no operating precautions are necessary.

The aim of any protective measure is not to prevent exposure, as such, but rather to keep exposure at a harmless level. Safe levels of exposure are termed "maximum permissible" levels, and they vary with the nature of the hazard. Safety precautions in laboratories where a variety of isotopes are handled are, by necessity, much more stringent than in a factory where a single isotope is used for a special purpose.

In laboratories, loose or unshielded radioactive materials are potentially a hazard because the electrical charge of radiation makes it adhere to dust and other particles in the air and on surfaces. Since removal from rough surfaces such as concrete, wood, or unfinished steel would be difficult, glossy paint, stainless steel fittings, and smooth, glossy floor surfaces are used throughout.

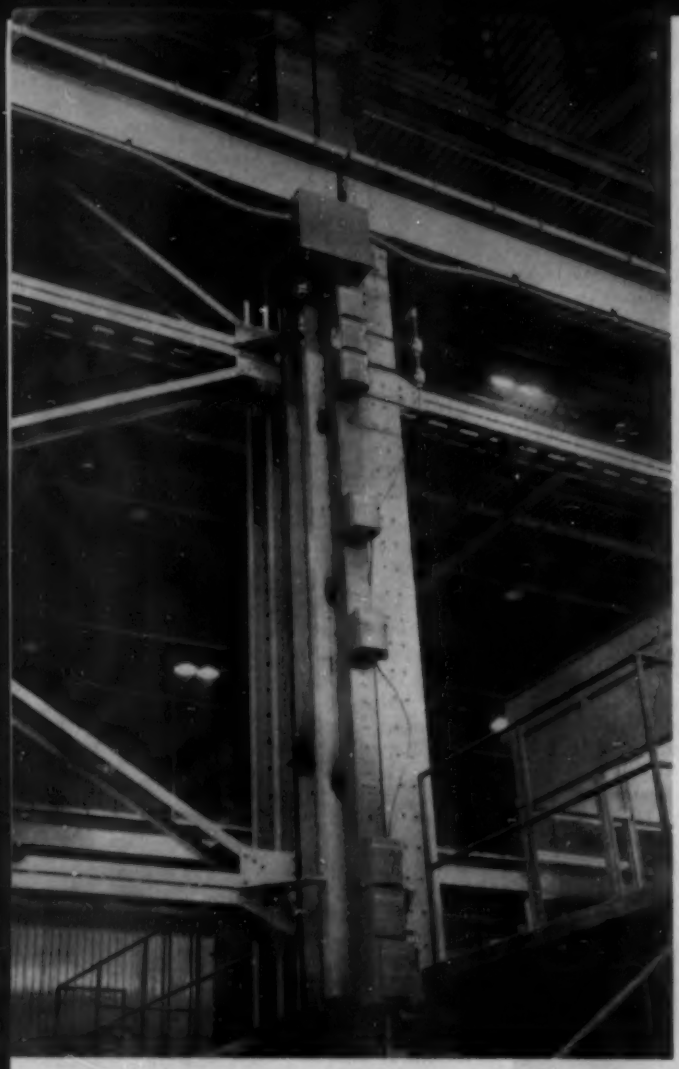
Industrial Instruments

Industrial instruments made by reputable manufacturers are completely safe and can be easily handled. Among these instruments are the beta gage, the dyestuff contamination unit, the isotope anemometer, the package monitor, and the I. D. static eliminator. These instruments embody suitable shielding designed to keep exposure within the safe permissible level fixed by the authorities. In general, many of the machines and chemical substances used in industry, and readily accepted in every-day practice, are actually more dangerous than the use of isotope techniques.



Isotope Products Ltd.

Using gamma gage to perform a traverse test on a high temperature pipe elbow.



How G.E. Lights Their Own New Plant

General Electric has made use of the latest developments and the best engineering thought in designing the lighting for their new Rome, Ga., plant

H. E. HEDDESHEIMER
Supervisor of Mfg. Facilities
Rome, Ga.

Armor cable running along horizontal building girders is tapped at junction boxes for vertical runs of plug-in duct on building columns.

IN THE LATTER PART of 1951, plans were being made by the General Electric Company to build a medium transformer plant in Rome, Ga. One of the numerous items that required engineering attention was the design of the lighting and power distribution systems. Decisions had to be made on the method of distribution, distribution voltage, interlocked-armored cable vs cable in conduit, and 120-volt vs 277-volt lighting.

A 480Y/277 volt, four-wire, combined power and lighting circuit was felt to be the most satisfactory for the following reasons:

¶Lower installation cost—the higher voltage system can carry power through smaller cable and wires with less losses and voltage drop. For heavy loads, such as are expected in the Rome plant, the copper savings are very pronounced.

¶Easy expansion—the adaptability of this system is excellent.

¶Less hazard—areas may be completely de-energized by one breaker for maintenance work as required.

¶Flexibility—power rearrangements and circuit growth problems are greatly reduced when equipment in an area has to be moved or changed.

System Flexibility

The distribution system from the load centers uses interlocked armored cable consisting of three 500-mcm conductors for the power and three No. 4 conductors (in the void spaces formed by the larger conductors) for the neutral. The tap-offs to service loads throughout the plant are made by mounting 400-a bus duct vertically on building columns. The top section of the vertical duct contains four busses to accommodate a four-pole plug-in switch for the high-voltage fluorescent and mercury vapor lighting. The lighting circuits operate at 277 volts, which is the line-to-neutral voltage of the 480-volt, three-phase, plant distribution power system. The remainder of the vertical duct is three-bus to supply three-phase, 480-v power to the machines throughout the plant.

The plug-in switches have current-limiting fuses. This scheme eliminates many wall-mounted circuit breakers throughout the plant. The interrupting capacity is more than sufficient with the fuses. Changes in power supply required by moves and relocations of equipment demanding larger or smaller fuse protection is easily accomplished by merely changing a plug-in switch. These switches are available in a large number of current ratings. There are 240-v and 120-v single-phase outlets provided on alternate columns throughout the buildings.

The two-story, 54,000-square-foot office building is entirely lighted by instant-started fluorescent lamps equipped with 277-v ballasts. Lighting control is through a 24-volt remote control system. The lighting fixtures are eight feet long, mounted in continuous lines on ten-

foot centers. The reflectors are slotted on top to give 40-percent lighting, which gives a pleasing and satisfactory effect for office lighting —with approximately 50 foot-candles at desk level. Power for air conditioning and blueprint equipment, cafeteria, and similar usage is drawn from the same feeders supplying the lighting circuits. Small dry-type, 480-240/120 volt transformers are used for these 240-v and 120-v loads.

Cascade Control

The low-bay area factory lighting is similar to the office lighting with three main exceptions:

¶The reflectors are slotted for 10-percent upward lighting.

¶Control of the factory lighting is accomplished by use of a cascade system. Each section of the building has but one push button for its lights; closing this push button energizes a contactor for one group of lights. However, an auxiliary contact energizes the contactor for the next adjacent group of lights and so on until all of the lights in that section of the building are either on or off. The advantage of this system is in allowing control of all lights in one section by using one push button while limiting the current in any one push button (and associated control wiring) to only that amount necessary to operate the one particular contactor coil.

¶The light density is approximately 35 foot-candles as against the 50 foot-candles for office use.

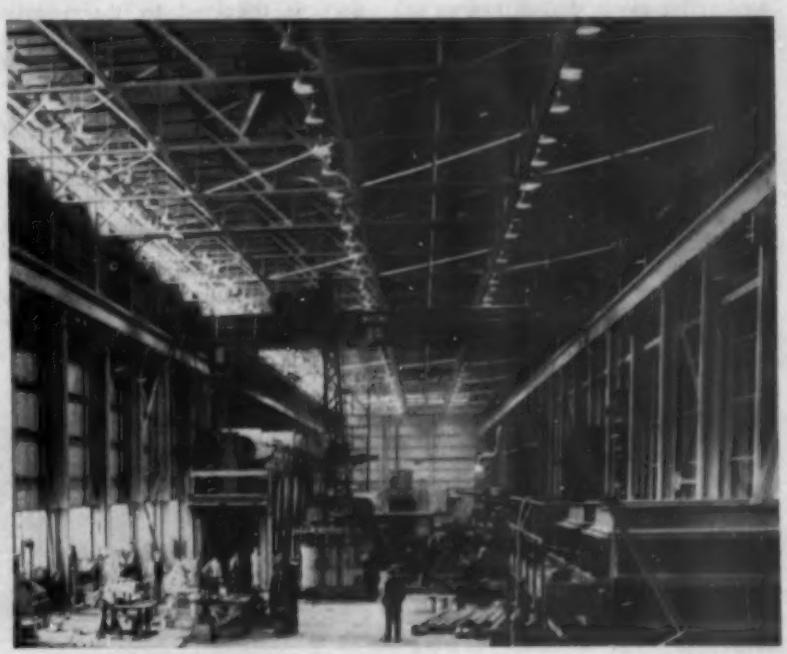
The high-bay factory lighting consists of an alternate-staggered combination of mercury vapor lamps and incandescent lamps. These are mixed to modify the blue lighting which would be given by using the mercury vapor alone and to allow partial instant lighting when the lights in an area are turned on. There is an eight minute time delay before the mercury vapor lamps reach maximum brilliance; furthermore, in the event of a momentary power failure, five minutes would be required for cooling and restarting the mercury vapor units.

The mercury vapor lamps, with ballasts, use 277-v, line-to-neutral, just as the fluorescents. The incandescent lamps are 1000 watt, 120-v; they are supplied in groups of three by using 3-kva, 480/240-120 volt transformers. The same power drop that feeds the mercury vapor lamps is used for the primary of the transformers; the on-off control is accomplished by application of cascaded contactors.

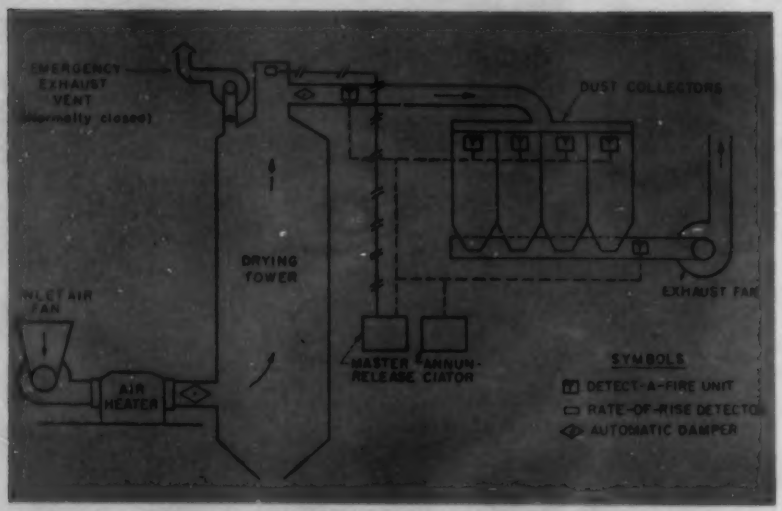
Fluorescent lighting in low-bay area is provided by 8 ft lamps mounted in continuous lines on ten foot centers. System uses 277 v from neutral of 480 v.

The initial savings in this installation and the economies of operation are no less important than the flexibility this system gives. Because of the 480Y/277 volt system, and the one-system, plant-wide method of distribution, equipment and processes can be moved as needs dictate—moved much more freely than would have been possible with a separate, lower voltage lighting system.

Flexibility is very necessary in a new plant with nearly half mile of conveyors, new processes, and new machinery. The use of a conveyor line for assembly makes good lighting especially important.



High-bay factory area uses alternate-staggered combination of mercury vapor and incandescent lamps. This modifies blue light given off by mercury lamps alone.



Schematic diagram of the automatic overheat/fire protection and alarm system in the spray drying towers and dust collectors in Lever Brothers plants.

Automatic Fire Protection

With Sealed Detectors

OVERHEATING AND FIRE are now a remote possibility in the continuous spray drying towers in Lever Brothers plants because of a well-planned, thermostatically-actuated safety system. The system automatically shuts down the drying operation and actuates a variety of devices to retard combustion in case fire or overheat conditions develop inside the towers.

The function of the drying towers is to evaporate water from a product-and-water slurry that enters in a continuous stream at the top of the tower. As the slurry moves down through the tower, it contacts a stream of heated air which extracts the water and exhausts it to the atmosphere. The dried soap collects in granular form at the base.

Because the hot air is fed continuously into the tower, certain types of malfunctions, such as a stoppage of slurry flow, could result in a serious overheating inside the tower, perhaps to the ignition point of the product. Hence, an elaborate system of safeguards was built into the towers to sense abnormal heating conditions and take remedial action before dangerous temperatures are reached during drying operations.

The safety system, for the most part, is triggered by thermostatic controls located at various potential danger points. Two such controls are located at the upper part of the tower where the greatest heat build-up usually occurs. One of these controls is a rate-of-rise detector which responds when the tower temperature rises at an abnormal rate. The other is a fixed temperature detector. In addition, each of the dust collector bins that extract finely-divided dust from the exhaust stream is similarly protected. The detectors trigger an automatic safety system called the "master release."

The purpose of the master release is to shut off the heater and cut off the forced draft system so as to create poor combustion conditions inside the tower. When the master release operates:

(1) The air heater shuts off, eliminating further heat input.

(2) The air inlet and exhaust fans shut off, and their corresponding dampers are closed, eliminating the normal air stream in the tower.

(3) A special damper in exhaust stack opens, venting collected heat to atmosphere.

(4) Alarms sound both in the plant and at a central fire station to summon assistance to the scene.

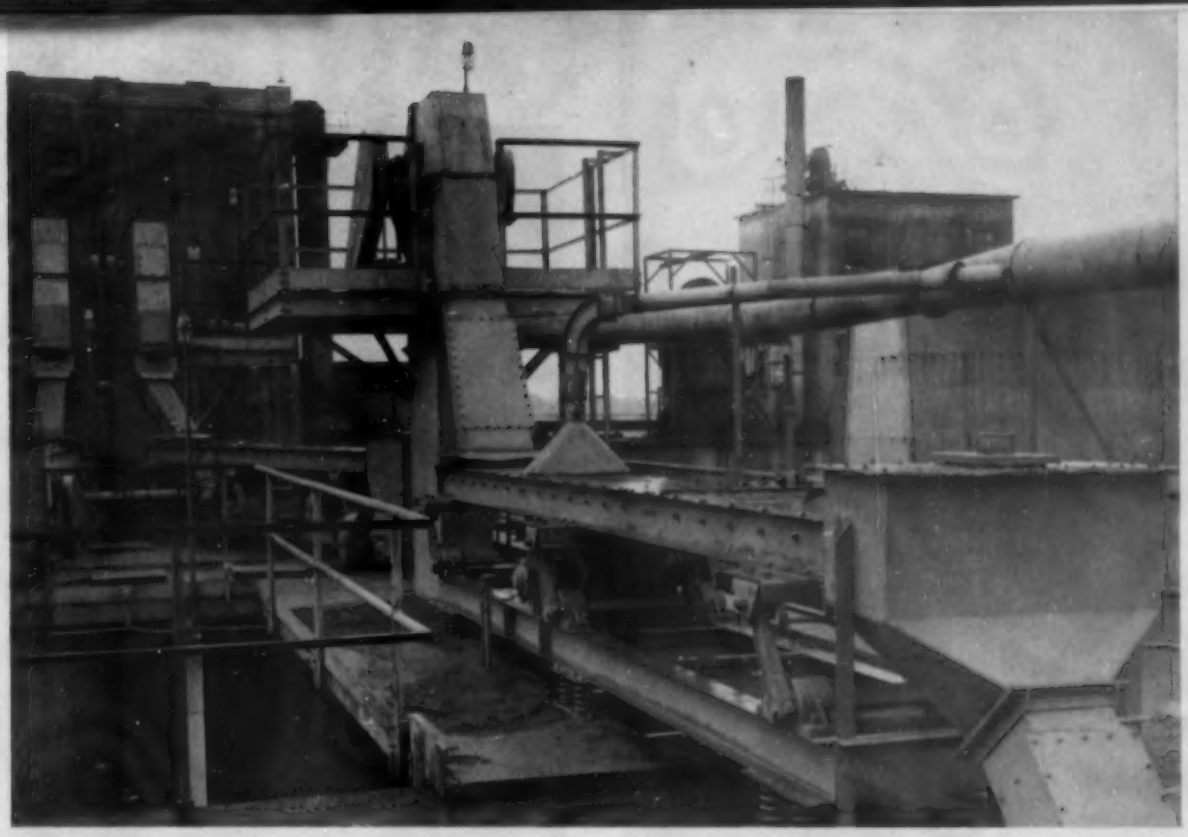
In addition to the automatic shutdown of equipment during an overheat emergency, a manually-operated, water spray fire extinguishing system inside the tower is available for use by the plant personnel.

Difficult service conditions inside the towers required a careful selection of the actuating controls. The fine soap dust always present inside the tower presents a serious problem in obtaining reliable, instantaneous operation of the overheat detectors.

This problem was overcome by selecting a hermetically sealed detector. The contacts that actuate the master release circuit are hermetically sealed inside a stainless steel outer shell, which protects them against dust, water, and possible corrosion. Because of the seal, the units are inherently explosion-proof and therefore safe to use in any atmosphere containing dust or combustible gases.

Furthermore, the detectors are self-resetting, so that they will operate repeatedly without resetting or readjustment. Normally-closed detectors are used in the master release circuit, so that, in case of a break in the wiring, the system will "fail safe."

Cut-away of one of the hermetically sealed detector units located in the towers. Lever Brothers uses a normally-closed fail-safe type circuit.



These spring mounted oscillating conveyors handle highly abrasive silicon carbide. System capacity is 120 tons per hr.

Oscillating Conveyors . . . Design and Application

ALBERT MUSSCHOOT, Link-Belt Co.

MODERN OSCILLATING conveyors offer many advantages as a method for separating, grading, cooling, drying, processing, or conveying a wide range of materials. Basically, these units consist of a continuous conveying trough mounted on inclined supports or legs, plus some form of mechanical eccentric drive supported on a base member and attached to the trough. Rotation of the eccentric mechanism results in an upward and forward oscillating motion of the conveying trough, moving large volumes of material in a uniform continuous flow.

Conveying Action

While the trough travels primarily in a path approximately at right angles to the supporting elements, the motion imparted by the eccentric mechanism produces horizontal and vertical component accelerations and decelerations of the trough itself. When the vertical accelerations exceed that of gravity (32.2 feet per second per second) the material actually leaves the conveying trough and travels in a hopping action. If the accelerations are less than gravity, the material does not actually leave the trough, but the pressure between the material bed and the trough is at a minimum as the material is sliding forward.

Typical applications illustrate the versatility of this design. Materials currently being handled range from dust at six microns to castings weighing 250 pounds or more, from cake mix to abrasive carborundum and sintered ore, from metallic concentrates at zero percent moisture to streptomycin waste at 85 percent moisture, from chips and turnings at room temperature to sinter at 1200 F and higher.

Design Considerations

In determining the capacity of oscillating conveyors for any specific material, there are three basic elements which must be considered: (a) stroke or displacement of the trough, (b) speed or oscillations per minute, and (c) angle of the trough, supporting elements, or legs with the base. Depending upon the particular design or application of the conveyor the stroke will vary from ½ to 1½ inches and the oscillations per minute from 575 down to 400 or less. The leg angle approximates 60 degrees. When combined, these three elements can be termed the intensity of oscillation.

An intensity of oscillation that causes hopping action on the trough produces the maximum speed of travel (as much as 100 feet per minute) of the material, while values which result in the material almost but not quite leaving the trough give slower conveying speeds but substantially reduce noise and degradation of the conveyed material.

For any specific application,

Multiple arrangements with small conveyors feeding a single larger unit are excellent for many conditions.

Conveyor shown above is 80-ft long. The 12-in. wide by 4-in. deep trough carries broken bottles in a brewery.

therefore, the intensity of oscillation will depend upon the nature of the product and its coefficient of friction. An intensity which would cause rough castings, for example, to hop on the conveying trough would cause considerable noise and possible breakage.

When conveying chemical pellets, corn flakes, soap flakes, or various other materials, the intensity is particularly important because degradation must be kept at a minimum. On the other hand, materials such as flour, copper concentrates, or dust collector fines are of a nature that degradation is not considered, and no objectionable noise would be developed by the conveying of the material.

Minimum Speeds

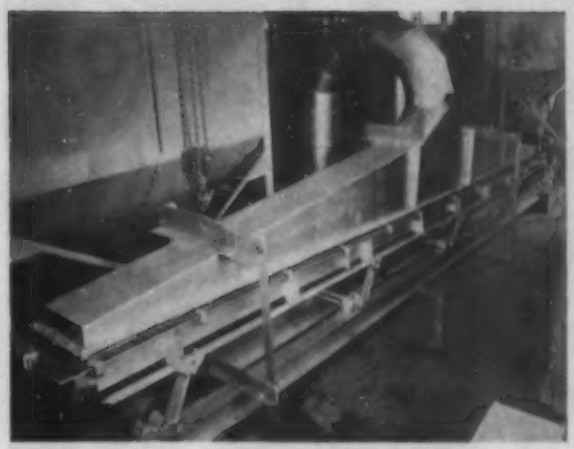
Where slow travel is desired for cooling or processing, 5 to 10 feet per minute represents the minimum practical speed because the conveying action in the lower ranges is critical. A point may be reached where material does not convey but moves back and forth with the trough. However, where very slow speeds are desired, the conveyor may be equipped with a timer and operated intermittently.

Although normally installed in a horizontal path, an incline of 10 degrees will generally reduce conveying speed and capacity by one-half. Conversely a decline of 15 degrees will double the capacity. Materials that aerate, such as cement or flour, must be considered with caution as the coefficient of friction is meaningless. Obviously material that is "floating" in air cannot be conveyed.

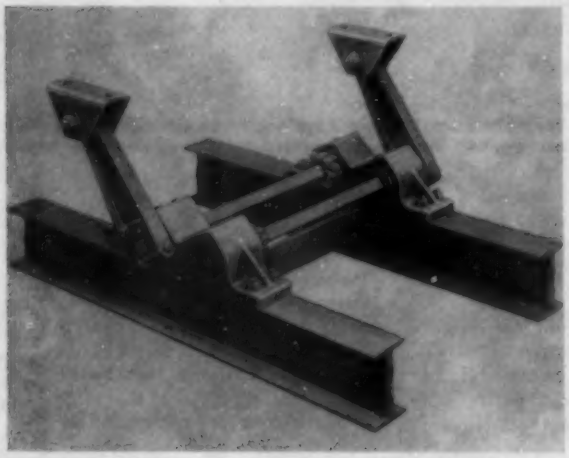
Typical oscillating conveyor moves sand and castings to a shake out. This unit is 48 in. wide by 40-ft long.

Basic construction photograph shows the arrangement of the trough, supporting channels, and leg assemblies.

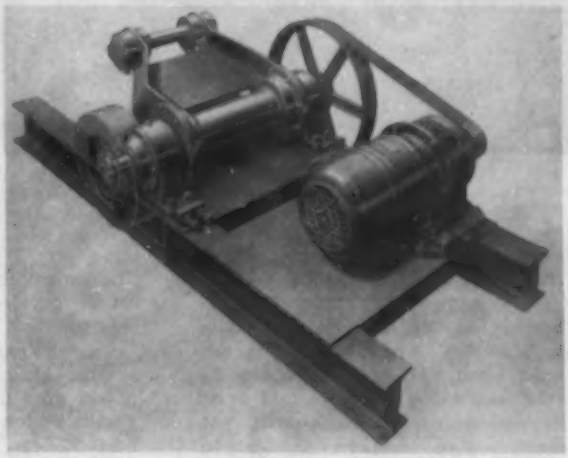
Right angle transfer from one conveyor to another is illustrated by this plant's system for handling debris.



System in the food industry uses overlapping louvres for drawing cool air through a bed of hot cocoa nibs.



Torsion bars are fixed at one end; free to articulate in steel-backed rubber bushings at the opposite end.



Eccentric drive elements include the shaft, bearings, connecting rods and linkage, V-belt assembly, and motor.

Brass chips, loaded near the discharge of this furnace charging conveyor, form a cushion for the heavy scrap.

Oscillating conveyor, with integral hopper for uniform feeding, delivers broken glass or cullet to a crusher.

How to Pick Centrifugal Fans

R. G. LUBINSKY
Manager, Fan Department
The Trane Company

Shop photograph shows a typical, large centrifugal fan. This unit has self-limiting, nonoverloading power characteristics.

IN SELECTING the proper fan for a given application, a number of decisions must be made. The type of fan, fan arrangement, fan noise level, system static, operating cost, and many other factors must be considered. Engineers may not always give detailed thought to each of the items when actually making a selection; through experience they learn how to combine variables, how to judge what is best for a given situation.

Opinions vary regarding the complexity of picking the proper fan. Experienced men frequently disregard most of the details, and they may consider fan selection to be a very simple operation. Others, with limited fan selection experience, concerned with getting exactly the right fan, may feel that much work and thought is involved in arriving at the right final decision for a specific application.

Fundamental Considerations

There are three important items to be taken into account when making a fan selection. These are:

The fan must deliver enough air to properly ventilate and heat or cool the space being served.

This must be done without an objectionable increase in the normal sound level of the area.

The economics of the installation must be decided:

Is low first cost or low operating cost more important?

What type of centrifugal fan will give the most desired results at the lowest cost?

Before a specific fan can be selected, there are a number of factors that must be calculated or determined. These items include:

Total air volume requirements of the installation, in cfm.

Static pressure of the fan system.

FAN LAWS

Fan performance follows a number of natural basic laws. Many of these laws are of immeasurable help to fan development engineers, but do not ordinarily interest fan application engineers. The following six basic laws, however, greatly simplify the work of engineers working on fan applications. (Relationships are for a fixed fan size and system)

Variation in Fan Speed — Constant Air Density

Air volume (cfm) varies as fan speed (rpm)	$cfm_2 = cfm_1 \times \frac{rpm_2}{rpm_1}$
Static pressure (sp) varies as square of fan speed (rpm)	$sp_2 = sp_1 \times \left(\frac{rpm_2}{rpm_1}\right)^2$
Power (hp) varies as cube of fan speed (rpm)	$hp_2 = hp_1 \times \left(\frac{rpm_2}{rpm_1}\right)^3$

Variation in Air Density — Constant Fan Speed

Air volume (cfm) is constant	
Static pressure (sp) varies as density (d)	$sp_2 = sp_1 \times \frac{d_2}{d_1}$
Power (hp) varies as density (d)	$hp_2 = hp_1 \times \frac{d_2}{d_1}$

These density laws are used throughout this article on fan selection.

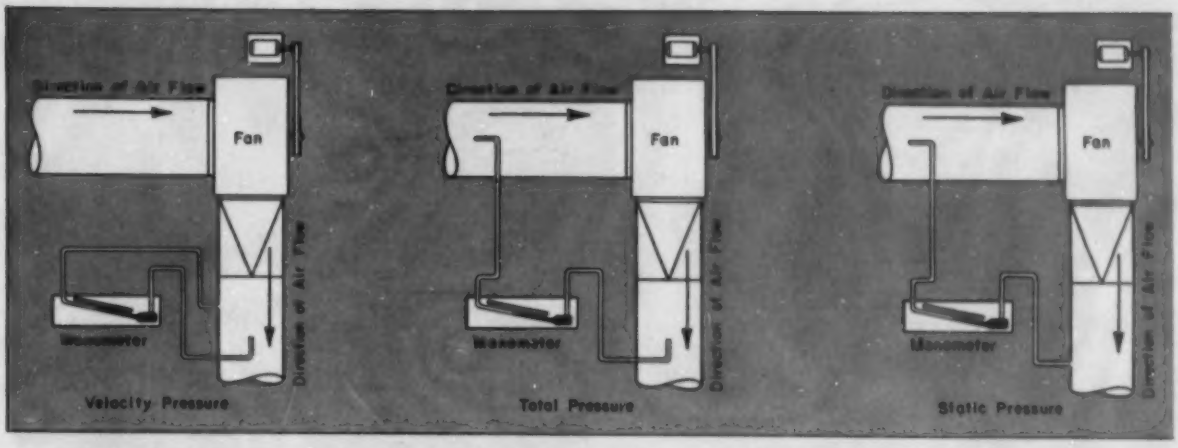


Fig. 1—Fan pressures are determined as shown above. Velocity pressure (VP) is the velocity pressure at the fan outlet. Total pressure (TP) is the difference between the total pressure at the fan inlet and the total pressure at the fan discharge. Static pressure (SP) is the difference between the fan total pressure (TP) and the fan velocity pressure (VP).

Density of the air to be handled.

Fan arrangement—as dictated by the application.

Equipment room location as it affects acoustics.

Duct design as it affects noise transmission and attenuation.

Normal sound level of conditioned space.

Fundamental noise principles.

Air Volume Required

The air volume in cfm is determined by the heating, ventilating, or air conditioning requirements. It must be remembered that the air volume used in making the fan selection is that measured at the fan discharge. This air volume can be effected by temperature changes and may be different from the air volume in other parts of the system.

Fan Static Pressure

Fan static pressure can be calculated from friction charts for ducts, grilles, coils, filters, and other equipment. If pressure calculations are to be exact, it is important that velocity pressure be taken into account. The best way to avoid error is to calculate total pressures in the ducts at the fan inlet and discharge by working back from the ends of the supply and return duct systems.

Fan static pressure is often miscalculated. By definition, fan static pressure is fan total pressure less fan outlet velocity pressure. Fan total pressure is the total pressure at the fan outlet minus the total pressure at the fan inlet. Fan velocity pressure is the pressure corresponding to the average velocity at the fan outlet. Boiling this all down, fan static pressure can be calculated by subtracting the total pressure at the fan inlet from the static pressure at the fan outlet (Fig. 1).

Air Density

For ordinary heating, ventilating, and air conditioning work, the air density is usually close to the standard density at which fans are rated, and the fan selection can be made without further correction. However, when temperatures are high or low, or the installation is to be made at a high elevation, proper corrections must be applied before the fan is selected.

When a fan is to handle air at conditions other than standard, certain corrections must be made both before and after the actual selection is made from the fan performance tables. At a given speed, with no change in fan volume, the static pressure and horsepower will vary directly with the density.

The chart (Fig. 2) gives the ratio of air density at various temperatures and altitudes to standard air. Before corrections are made, it must be determined that the cfm and static pressure are stated in terms of the actual temperature and altitude and not in terms of standard air. (All air friction charts on ducts, filters, coils, and similar equipment are based on standard air and corrections must be made to determine the proper losses at other conditions.)

Corrections are made as follows:

1. Select correction factor from the air density ratio chart, Fig. 2.

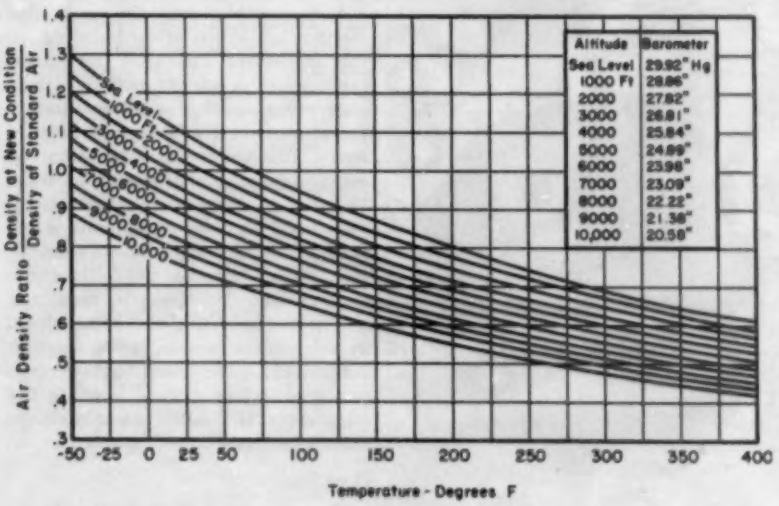


Fig. 2—Chart gives air density ratios at various altitudes and temperatures.

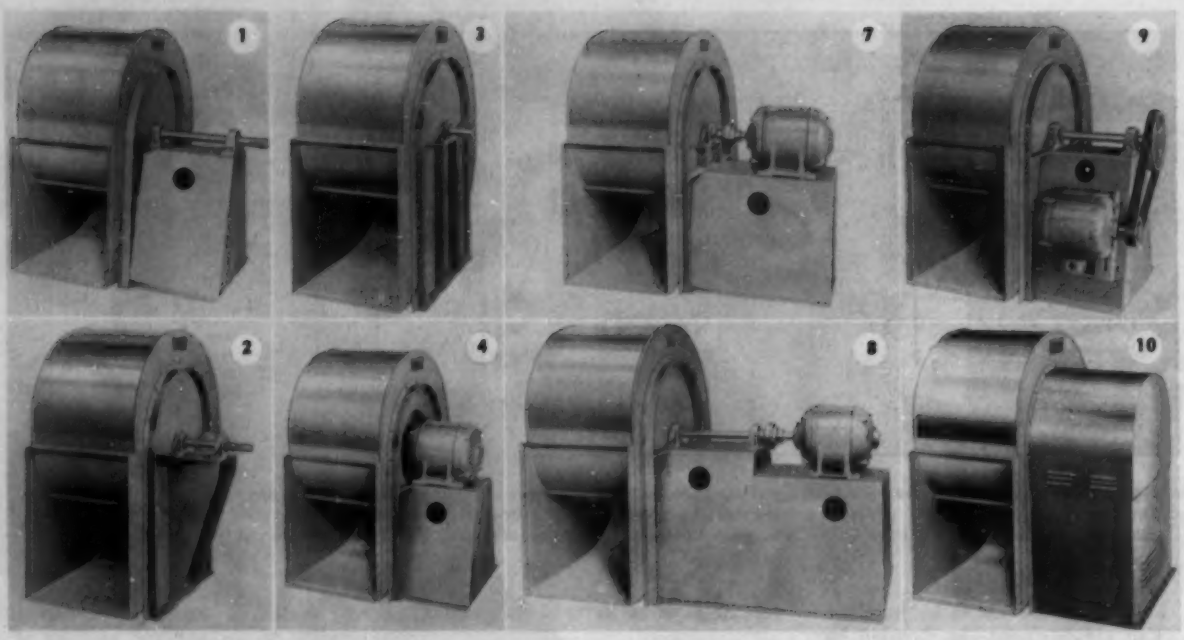


Fig. 3—Standard fan arrangements (Nos. 5 & 6 have been discontinued) are shown above. No. 10 is a Trane exclusive.

2. Divide static pressure at the nonstandard condition by the correction factor.

3. Use the given cfm and the corrected static pressure to determine the rpm and bhp from the performance tables.

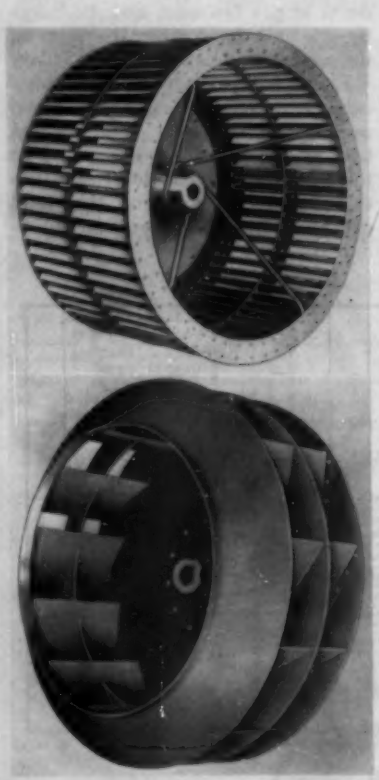
4. The rpm is correct as selected.

5. The bhp must be corrected by multiplying it by the correction factor determined in Step 1. This will result in the actual operating bhp. If a fan is selected to operate at an elevated temperature, it must be kept in mind that it may sometimes operate at lower temperatures. Therefore, the motor selected must be large enough to handle the increased power requirement.

Fan Arrangements

The type of application will govern, to a large extent, the fan arrangement to be used. There are a number of standard arrangements (Fig. 3) designed to allow flexibility in meeting individual problems. For example, if the fan is to be installed within a plenum, an inlet duct connection to the fan is not necessary and one of the double width units may be satisfactory.

When it is necessary to connect a duct directly to the fan inlet, or when it is essential that bearings be out of the air stream, one of the single width arrangements should be selected. Arrangements with bearings at the inlet are not recommended for high temperature, low temperature, or dirty air conditions. In these cases, it would be best to use an arrangement with bearings out of the air stream. Arrangement 10, a Trane exclusive, has a hood over the motor and drive. It is designed for installation when protection of the motor and drive against the weather is desired.



Figs. 4 & 5—Top, forward curved and bottom, backwardly inclined blading.

Equipment Room Location

Location of the equipment rooms with respect to the conditioned spaces is an important consideration to bear in mind. If the room is surrounded by occupied spaces, where maintenance of a low sound level is important, the fan must be selected with quiet operation as one of the prime considerations.

For example, consider an equipment room in an office building. In this theoretical structure the equipment room is surrounded by a private office, a doctor's consultation room, a general office, and a lecture room. The fan for this job must be quiet, and special precautions must be taken to avoid noise transmission.

In another case, equipment is installed in a basement below a kitchen. The fan supplies air to an auditorium used for concerts, meetings, and lectures. While the sound level in the auditorium is, under certain conditions, quite low, fan selection is not nearly as critical because the equipment is located at a distance from the conditioned space.

Duct Design

The size of fan that should be used will be affected by the length

of duct, the number of elbows, and the amount of sound absorbing duct lining between the fan and first outlet. If the first outlet of the duct supplying air to the room is close to the fan, there is little chance for natural attenuation of noise in the system. If the first opening is far from the fan or there are a number of elbows between the fan and the outlet—and the duct is lined with acoustical insulation—there is a good chance that most of the fan noise will be absorbed in the system. Under these conditions, a smaller, noisier, but lower priced fan may give satisfactory results.

Normal sound levels can be measured directly with sound meters, or they can be estimated from tables such as are given in the ASHVE Guide.

Noise Principles

With regard to noise, two fundamental principles must be understood. These are:

The most efficient fan of a given type is the most quiet. If extremely quiet operation is desired, the most efficient fan that will satisfy the capacity should be selected.

High static pressures and high fan noise go together. In order to deliver air against a relatively high static pressure, the fan must operate at a fairly high speed. As speed increases, fan noise levels increase. The same fan operating at high speed is noisier than when it operates at a lower speed.

If the most efficient fan that can be selected for a given condition is not sufficiently quiet to produce the desired results within the conditioned space after taking into account acoustical insulation and distance of outlet from the fan, the only way to reduce the noise level is to redesign the system for a lower resistance.

Many engineers use recommended outlet velocities and tip speeds from tables found in the ASHVE Guide as an aid in selecting fans. Actually, these values serve only to keep the fan selection within an efficient range and indicate that selections are to be made near the top of fan rating tables rather than in the middle or near the bottom. Some manufacturers indicate efficiency zones on fan rating tables. This information serves as a constant reminder to select efficient fans. When using tables on which the efficiency is indicated, one can forget about outlet velocities and tip speeds and simply be sure that the fan is an efficient one. A fan selected from the highest efficiency zone will have the lowest outlet velocity of any fan of that particular type that will give satisfactory results. There will be times when it may be desirable to select fans from the lower efficiency zones, but under these conditions the fan selected will not be the most quiet.

Fan Types

There are two basic types of centrifugal fans commonly used for heating, ventilating, and air conditioning applications. They are classified by the curvature or slope of the impeller blades: the FC, or forward curved (Fig. 4), and the BI, or backwardly inclined (Fig.5). For a given output, the FC operates at a relatively slow speed, while the BI operates at a relatively high speed. A study of the performance curves of each type will show the essential difference.

BI Fan Performance

The characteristic curves for BI fans (Fig. 6) show that these fans have a steep pressure curve and a true nonoverloading power characteristic. The steep portions of the curve indicate that this type of fan will tend to operate at constant capacity under quite widely varying pressures. This rising pressure curve is also a requirement for satisfactory parallel operation. The horsepower curve shows that these fans have self-limiting, nonoverloading power characteristics.

The point of maximum power consumption occurs at about 77 percent free delivery. At constant speeds, for either smaller or greater delivery volumes, the power requirements will be less than this maximum. Therefore, these fans are ideal for installation wherever pressure and air volume are subject to change. On systems where the air volume is to be controlled by dampers, these fans are particularly desirable. They are also ideally suited for process heating and drying and other industrial applications where

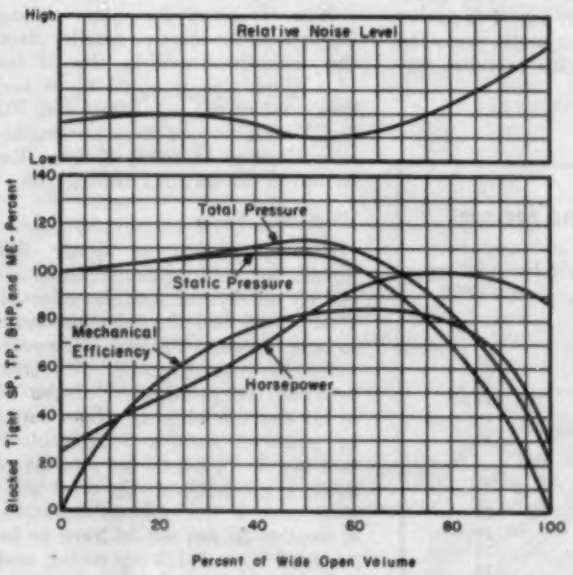


Fig. 6—Performance characteristics of typical BI fan.

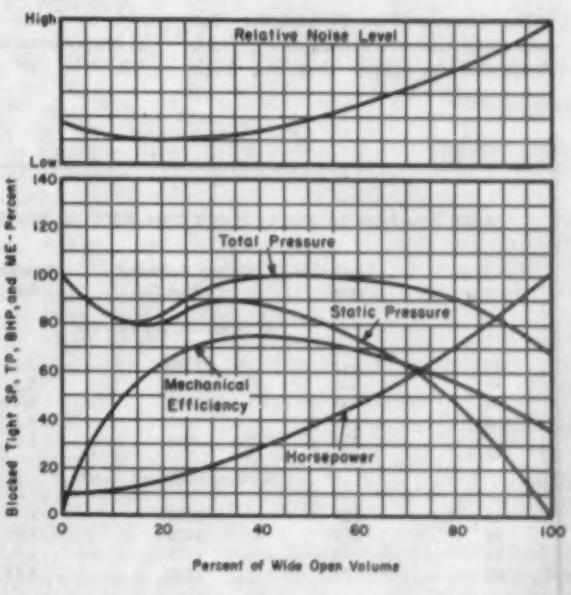


Fig. 7—Performance characteristics of typical FC fan.

TABLE 1 — VELOCITY PRESSURE

Fan outlet velocity fpm	Velocity pressure in. wg
800	.040
900	.051
1000	.062
1100	.076
1200	.090
1300	.106
1400	.122
1500	.140
1600	.160
1700	.181
1800	.202
1900	.225
2000	.250
2100	.276
2200	.302
2300	.331
2400	.359
2500	.390
2600	.422
2700	.456
2800	.490
2900	.526
3000	.563
3100	.601
3200	.640
3300	.680
3400	.723
3500	.766
3600	.809
3700	.855
3800	.902
3900	.950
4000	.999

the static pressure is subject to wide variation. Since BI fans operate at moderately high speeds, they frequently are preferred for direct connection to motors.

FC Fan Performance

The curves (Fig. 7) indicate the operating characteristics of FC fans. It should be noted that the high point of the mechanical efficiency curve occurs very near the high points of the total pressure and static pressure curves. It will also be noted that the top of the mechanical efficiency curve is comparatively level and slants off gradually to the free delivery point.

All fans should be selected to fall to the right of the high point on the static pressure curve but as close to that point as possible. The curves show that the area immediately to the right of the high point in the static pressure curve coincides with the highest arc in the mechanical efficiency curve. Therefore, a fan selected to satisfy static pressure requirements will operate at or near peak mechanical efficiency.

Fan Classes

There are four different classes of fans standardized throughout the industry by NAFM. Of these fans only the first two are used to any extent on heating, ventilating, and air conditioning jobs.

Class I fans are built for a maximum duty of 3-3/4 in. wg total pressure with standard air.

Class II fans are built for a maximum duty of 6-3/4 in. wg total pressure with standard air.

When the air density is less than standard, the fan must run at a higher speed to develop the same pressure. Maximum tip speeds remain the same, and the same maximum total pressures will apply but must be calculated as follows:

1. Determine actual outlet velocity and select velocity pressure from Table 1.
2. Divide the actual static pressure by factor from Fig. 2 to arrive at class-determining static pressure.
3. Add the velocity pressure figured in Step 1 to static pressure figured in Step 2 to arrive at total pressure to be used in determining fan class. If this total pressure is less than 3-3/4 in. wg, a Class I fan will be satisfactory. If it is between 3-3/4 and 6-3/4 in. wg, a Class II fan is indicated.

Single Width or Double Width

The available space, duct connections, air temperature, and degree of air contamination must all be considered in choosing a single width or double width fan. The cost of a DW fan will generally be less than an equivalent SW fan for the same duty. However, the DW cannot be used when inlet duct connections must be made or when bearings must be out of the air stream.

Fan Selection

Suppose that a fan to move 25,000 cfm of air against one inch static pressure (standard density) is required for installation in the office building described previously. It should be the most quiet fan that can be selected from those commercially available. After considering all factors, it will be seen that a single width fan is the best selection.

The ratings of five possible BI fans and four possible FC fans are given in Table 2. All of these fans will deliver 25,000 cfm at one inch static pressure. Which of the nine is best suited to this application?

Notice that the power required for FC fans exceeds that of the equivalent size BI fan for all sizes. If the selection were to be made entirely on horsepower, a BI fan would be the obvious answer.

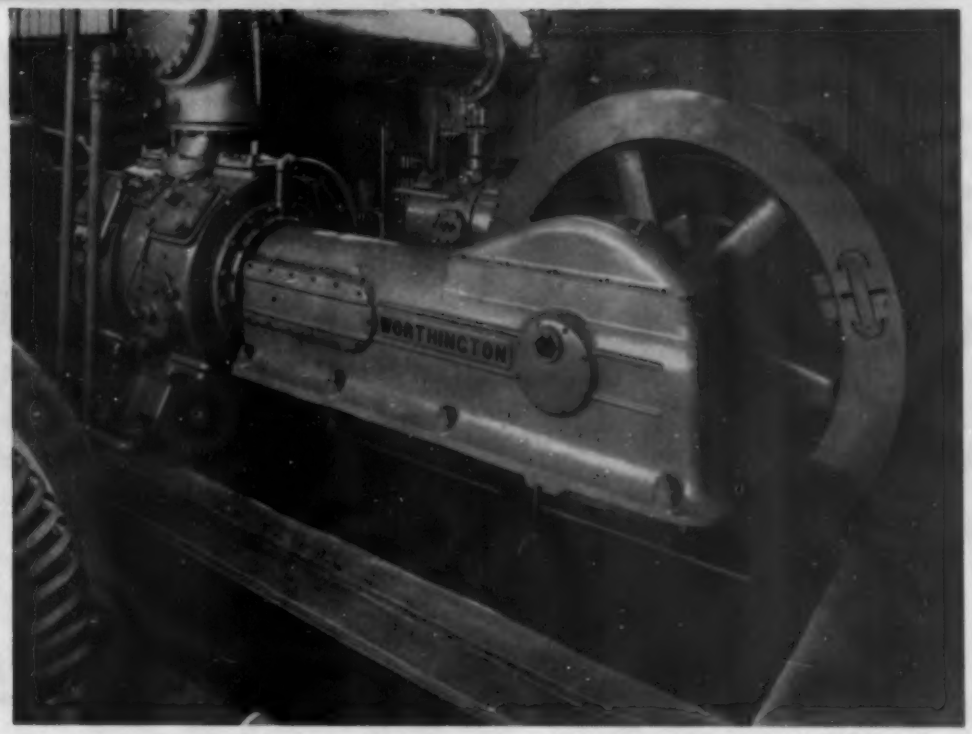
Now, look at the noise rating. Other than for the two smaller sizes, the noise developed by the BI fan of a given size is equal to or less than that of the equivalent size FC fan. Unless one of the two smaller sizes were to be selected, again the BI fan is the obvious choice.

Ultimate Choice

Remember that to satisfy this installation, the quietest commercially available fan must be selected. That would boil the selection down to the largest BI fan. However, there is such a small difference between the noise level of the 60 in. BI and the 66 in. BI (both could be powered with a 5 hp motor) that the 60 in. BI, in the interest of doing a good job at the least possible cost, is the obvious selection. A smaller BI fan would have to be powered by a 7-1/2 hp motor, and the noise level would be two decibels higher than the 60 in. size.

TABLE 2 — FAN RATINGS: 25,000 CFM AT 1 IN. WG STATIC PRESSURE

Fan Size inches	Speed rpm	Outlet Velocity fpm	Power hp	Noise Rating decibels
		BI Fans — Class I — SW		
44	547	2190	7.2	79
49	435	1800	6.1	76
54	350	1475	5.4	74
60	293	1210	5.1	72
66	251	990	5.0	71
		FC Fans — Class I — SW		
44	257	2190	8.1	75
49	223	1800	7.0	74
54	195	1475	6.4	74
60	173	1210	6.13	73



Because of the vibratory forces inherent in compressor operation, it is essential that the unit be properly mounted. The 600 hp compressor shown is installed in a tire manufacturing plant.

Practical Pointers on Compressor Foundations

H. W. WHITING
Assistant to Executive Engineer
Buffalo Works
Worthington Corporation

CONTINUOUS AND EFFICIENT operation of compressors will depend in part on the careful initial planning and design of the installation; especially the location and mounting of the compressor.

Location

The compressor should be installed in a clean, light place, with ample room provided all around to permit cleaning, inspection, adjustment, and removal of such parts as pistons, piston rods, and cooler nests without interference from adjacent machinery or building walls. Proper location of the compressor will materially reduce maintenance and operating costs.

All reciprocating machinery (specifically the single cylinder and duplex cylinder arrangements) have inherent vibratory forces due to the movement of the piston, connecting rod, and crosshead. In a measure, the force created by the movement of these members is partly neutralized by the counterbalance weight. However, because of the varying angularity of the connecting rod throughout the stroke, it is impossible with any weight of counterbalance to come within plus or minus 20 percent of balancing the horizontal reciprocating force.

Unbalanced forces

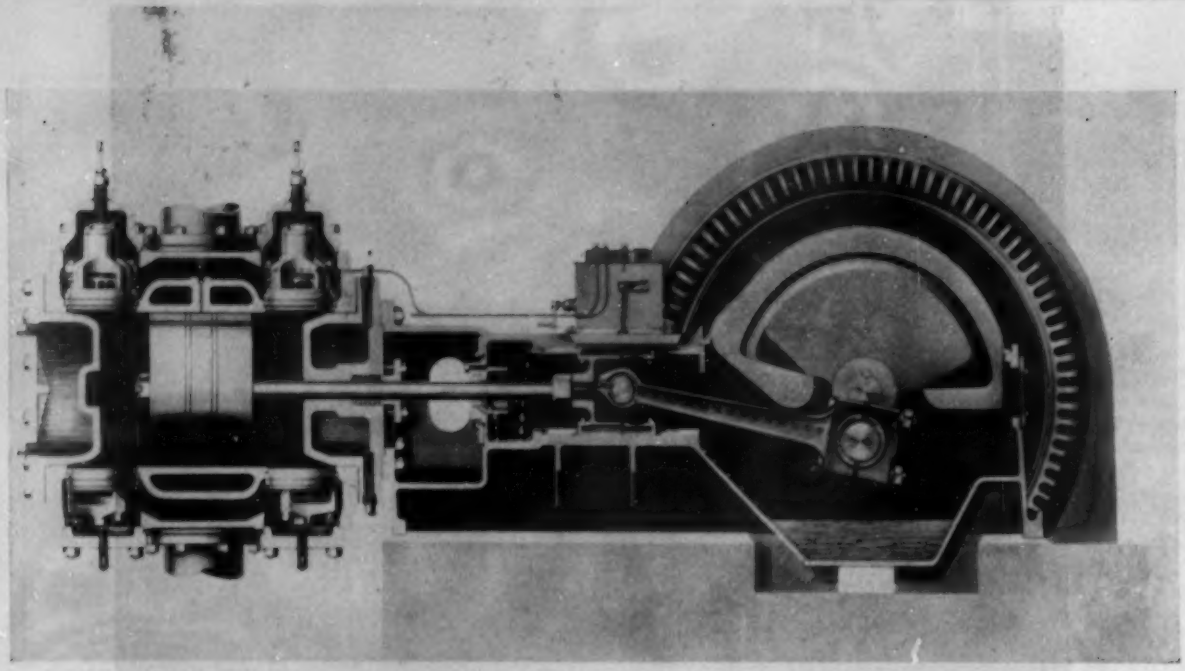
While the balanced-opposed and multicylinder compressors have individual reciprocating assemblies which produce unbalanced forces when rotating, the resultant combination of the horizontal forces of the several cylinders usually do not transmit any sizable lateral forces to the foundation.

But with a counterbalance, the vertical forces created by the counterbalance itself will then be almost as great as the horizontal force that would exist without any counterbalancing. It is because of this fact that the weight of the counterbalance must be compromised to keep both the horizontal and vertical forces to an average minimum.

Adequate foundation

Since these distributing forces are common to all compressors, it is necessary that an adequate foundation be provided to carry the loads and to prevent objectionable vibrations from being transmitted to the floor or other structural members.

The subsoil is checked by digging



Unbalanced forces created by moving piston, piston rod, crosshead, connecting rod can be only partially counterbalanced.

test pits to determine its nature. Load deflection tests are made for wet or springy soils. The actual unit loading should not be more than one-fourth the maximum soil bearing pressure because of the dynamic forces involved.

Soft clay, alluvial soils, loose sand and gravel, silt, and filled ground are poor supports for foundations of large reciprocating compressors. When such soils are found, the bearing area should be increased. With wet soil, piling may have to be used to provide the necessary vertical support. In such cases, it is usually good practice to install batter piles (piles driven at an angle at the foundation ends) to absorb the horizontal shaking forces.

Observing neighboring installations on similar soils may often help to determine the type of precautions that should be taken.

Wherever possible, the foundation is carried down to a firm footing. If the foundation is exposed to freezing temperatures, its depth should be below the frost line.

When the depth of the foundation is made greater than that shown on the foundation drawing furnished by the manufacturer, the base area of the foundation should be proportionately increased. An increase in base area is also necessary when the unit is elevated above the floor line a distance greater than that shown on the foundation drawing. If the sides of the foundations do not abut well tamped soil, the base area will again have to be increased.

In case more than one compressor is being installed, and they are located relatively close to each other, their foundations can be cast enbloc or separately on a common concrete mat, either being satisfactory.

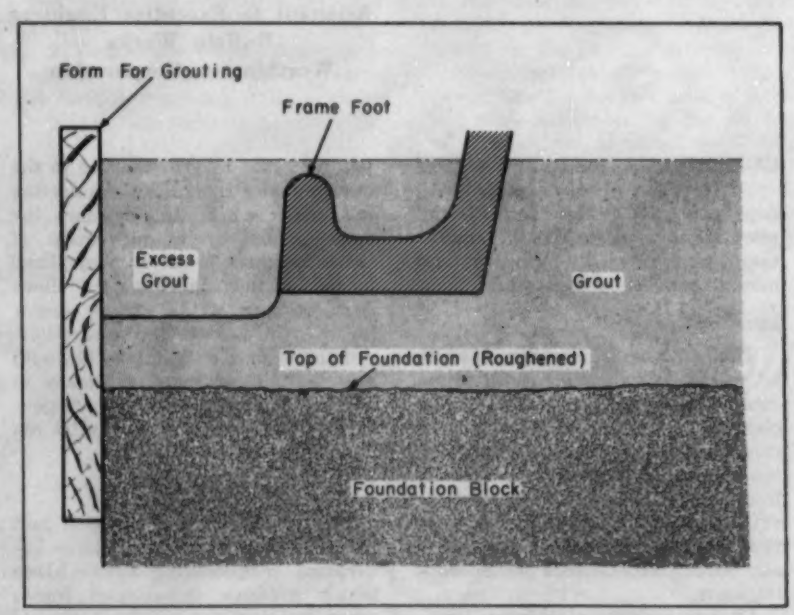
A foundation is a poor item to economize on. The extra cost of a good foundation is small, and the later cost in correcting cheap construction is always high and difficult to effect in an operating plant.

The foundation bolt material should not be of a lower quality than A1S1-C1120, which has the following physical properties:

Hot Rolled Steel

Tensile strength ..... 65,000 psi
Yield point ..... 38,000 psi
Elongation .....25 percent
Brinell hardness 117

Some reinforcement by means of



After the compressor is correctly aligned on the foundation, the unit is grouted-in (as shown by the sketch) to permanently maintain this alignment.

standard steel reinforcing rods can be used at each pit or opening in the foundation.

A foundation concrete mix of 3000 psi compressive strength at 28 days of age and a slump not to exceed 6 inches is recommended. This concrete mix should be made with durable aggregates of such gradation that not over 40 gallons total water, including moisture in sand and aggregate, be used per cubic yard of concrete. A cement dispersing agent may be added in the concrete mix. If aggregates are employed which contain reactive silica, then cement which contains less than 0.6 percent sodium and potassium alkalies must be used.

The minimum amount of water, as designated above, will provide ready placement and desired strength. The foundation should not be poured if there is any possibility that freezing might occur.

The top surface of the foundation, before the concrete takes its final set, is made rough by raking. This provides a good rough and irregular surface for the bonding of the grout —which will be applied after the equipment is aligned and set on the foundation. The surfaces are roughened to the extent that the aggregate will be exposed; and the indentations in the surface are at least ½ inch and irregular.

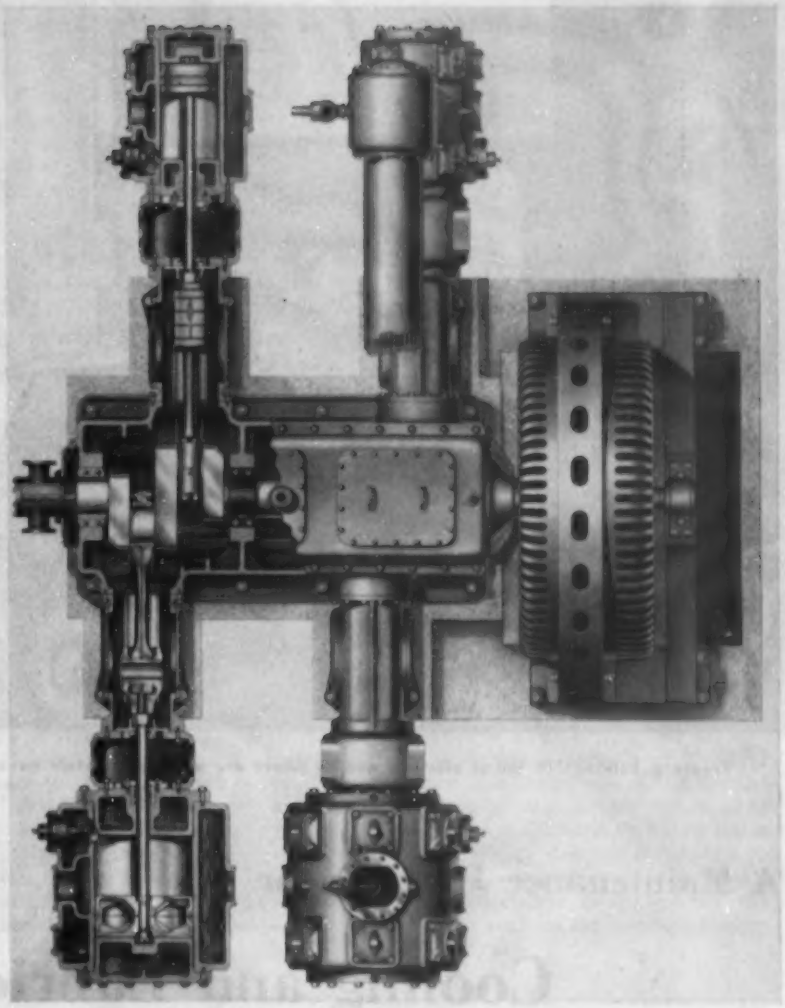
The foundation should be allowed to cure for at least a week before the equipment is placed. Curing is accomplished by the use of a curing compound or by keeping the surfaces wet for a period of 7 days if normal temperatures exist. At lower temperatures, the curing period is respectively lengthened.

For large foundations, the concrete is poured continually rather than poured in sections.

Grouting

It is extremely important that the compressor be properly leveled, aligned, and secured to the foundation. The alignment and assembling instructions given by the compressor manufacturer should be strictly followed. After the correct alignment of the compressor on the foundation is established, the unit is grouted-in to maintain this alignment.

A dam or form is built around the foundation sufficiently high to create a level of grout inside the hollowed-out portion of the frames at least 1 inch above the bottom flange face. Forms are also built around cylinder feet (if used) and motor soleplates or baseplates. The foundation is thoroughly moistened at least 30 minutes before the grout is poured and kept wet to insure a good bond between the foundation and the grout. After the alignment of the entire unit is rechecked, the grout is prepared using a mixture consisting of 1 part cement and 1½ parts clean, properly graded, concrete sand mixed with water to the consistency of heavy cream.



Balanced-opposed compressors have advantage in that resultant combination of horizontal forces usually transmits no lateral forces to foundation.

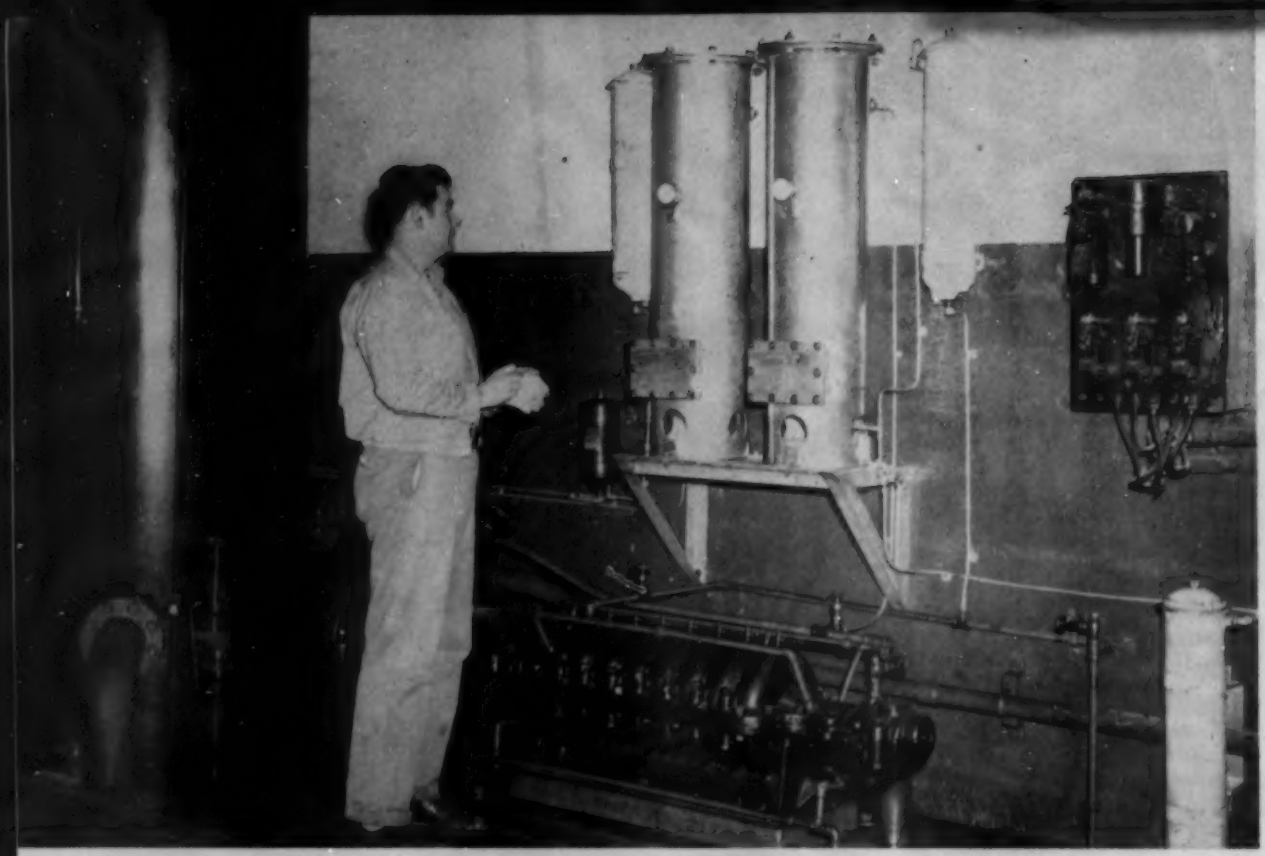
Procedure

First, the foundation bolt sleeves are filled to the top of the foundation with wet grout. The grout is then poured—preferably from one side of the frame—to all points within the form. The grout is spread evenly and worked beneath the frame flange eliminating any tendency to form air pockets. If there is any danger of freezing weather, the grouting should be postponed until temperatures above freezing prevail.

After the grout has completely hardened, all wedges and shims used in the alignment of the compressor are removed (provisions being made beforehand to facilitate their removal) and the space they occupied is regrouted.

The removal of the shims and wedges is absolutely essential. Otherwise, the compressor unit will be suspended, with metal to metal contact, on the wedges and shims and in time, due to reciprocating forces, will work loose from the foundation.

At all junctures between the compressor unit and the grout, it is advisable to apply several coats of shellac followed by paint to prevent any seepage of oil into these points. In fact, the whole foundation should receive similar treatment since oil has a very deleterious effect on the concrete or grouting—resulting in future trouble.



Treaters, holding 100 lbs of alumina, and oil filters are used to maintain governor and lubricating oils at Cheoah.

A Maintenance Program for

Cooling and Lubricating Oils

This successful lubrication and cooling oil maintenance program is for use with straight mineral and oxidation-inhibited oils for power systems. Oils with other inhibitors may require different treatment.

J. ELMER HOUSLEY, District Power Manager
Alcoa, Tennessee Works, Aluminum Company of America

MAINTENANCE of oils is sometimes neglected because of a lack of knowledge regarding the actual value of a program designed to remove the products of deterioration. Air and moisture, the principal enemies of oil, contribute to formation of organic acids and sludge which, if not removed, impair the efficiency of the oil and cause damage to the equipment it serves.

Regardless of whether an oil is used for lubrication or as an insulating oil in electrical equipment, it generally costs less to maintain it in good condition than to periodically replace it with new oil. Also, once a good maintenance program is established, it abolishes the need for cleaning and reconditioning the equipment as may have to be done whenever deteriorated oil is replaced with new oil.

These are not the only economic advantages of a good oil maintenance program, however. Even greater savings can result from increased life of the equipment, reduced maintenance on the equipment, and less down-time for repairs.

A program using Activated Alumina* for maintaining power system oils has proven highly successful at the Alcoa, Tennessee Works of Aluminum Company of America. Previously, about 30,000 gallons of re-

*Reg. Trademark, Aluminum Company of America.

placement oil, costing $6500, were required every five to six years for the transformers and switchgear. In comparison, the initial investment for equipment and alumina to prevent the recurrent need for new oil was $5000. This was the only major expense of the program, which has resulted in the usual over-all maintenance costs being reduced by one-half. Furthermore, the cost of preserving the oil with alumina has been less than 1¢ per gallon of oil per year, with labor performed by regular powerhouse personnel.

Although there are other materials used for treating oils, the characteristics of Activated Alumina make it particularly adaptable for this purpose. This material is able to adsorb and retain appreciable amounts of moisture and acid without objectionable changes in its form or properties. After becoming saturated, it can be reactivated by controlled application of heat. Although reactivation does impair the alumina's moisture adsorbing properties, it does not affect its ability to adsorb acids from oils, and there is no known limit to the number of times it can be reactivated and reused as an acid adsorbing medium.

Also, Activated Alumina has a high compressive strength and a high resistance to shock and abrasion. It is chemically inert to most gases and vapors and is nontoxic. In addition, it is a pure chemical compound, in contrast to the varying and often unknown chemical compositions of other filtration materials used for maintenance of oils.

Diesel Engine Oils

Low-speed, stationary diesel engines used for power generation are particularly receptive to Activated Alumina filtration treatment since they generally employ straight mineral type oils for crankcase lubrication. Activated Alumina filters indicate possible value in treating oils on the high-speed, mobile diesel engines as well.

Filters, through which the oils are continually by-passed during engine operation, are commercially available in several designs, and contain a disposable cartridge filled with Activated Alumina. As the oil passes through the alumina, acids and moisture are adsorbed, thereby preventing deterioration. The alumina is used in the form of a fine mesh so that it will also filter out carbon and metallic particles. Enough Activated Alumina is usually contained in a cartridge to equal 5 to 10 percent of the weight of oil in the crankcase. This amount may last 6 to 12 months or longer before the cartridge must be replaced.

When the filter is first employed, neutralization number tests should be run at frequent intervals to indicate a schedule for filter cartridge changes. Thereafter, these tests can be used to maintain the accuracy of the schedule. If this procedure is followed, the crankcase oils can be maintained at top quality with no need for replacement, other than infrequent additions of makeup oil.

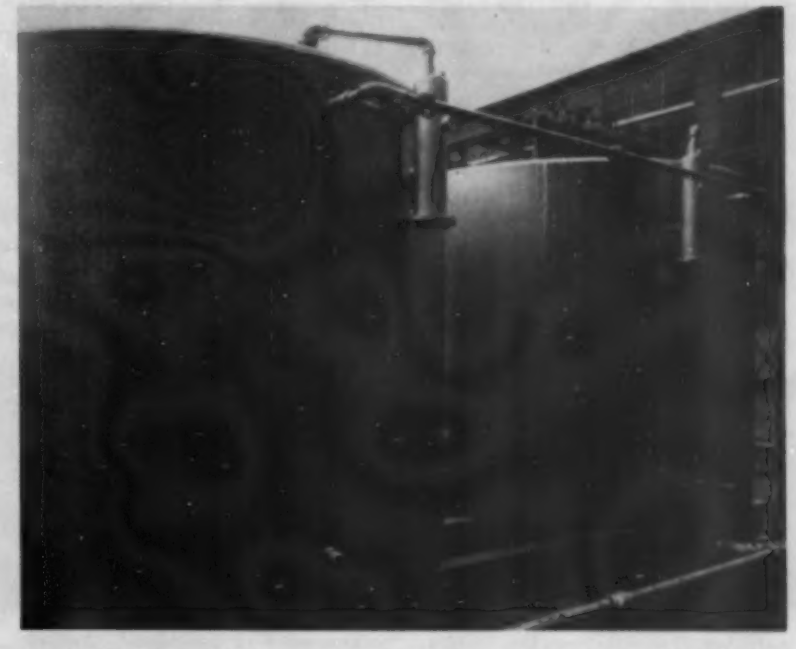
Lubricating Systems

By-pass treaters also can be effectively applied to centralized and unit type lubricating systems. If the system operates with oil pressure, one of the pressure lines can be tapped for the intake of the treater, and the oil leaving the treater can be piped into the sump or storage tank. If a pressure line is not tapped, a small pump can be used to force the oil through the treater. A resin stabilized paper filter should be placed in the oil flow following the treater to collect any dirt, alumina, or rust escaping the treater. Since clogging of the filter cartridges causes the pressure within the treater to rise, a pressure gage can be used as an indicator.

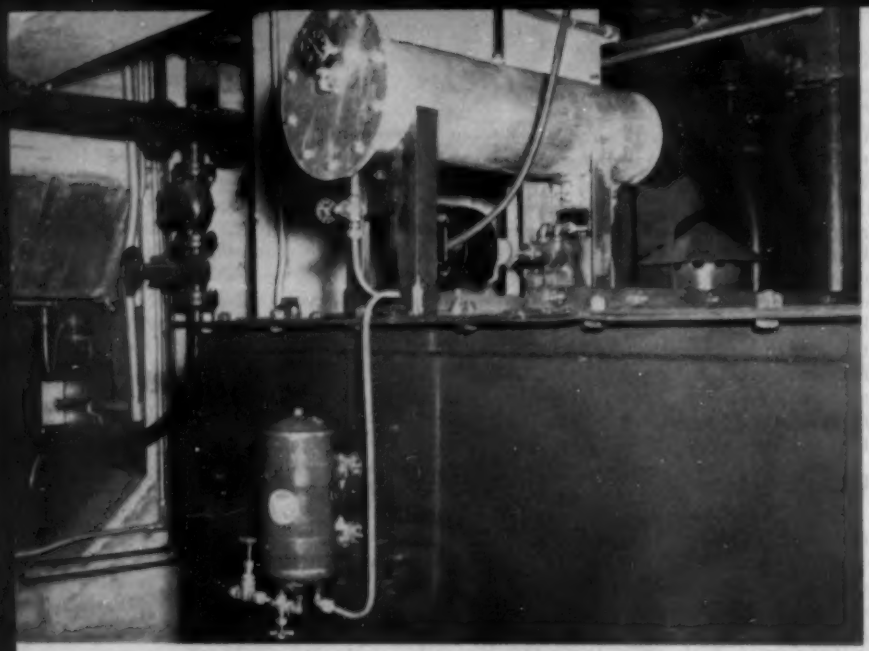
By-pass treaters for these systems are usually designed to hold standard 10-lb perforated cans of Activated Alumina. If space permits, it is recommended that the treaters be designed to hold an amount of alumina equivalent to 2 percent of the total weight of oil in the system. A treater containing this amount would normally require changing of the alumina only once each year although the exact timing should be determined by interfacial tension tests. Interfacial tension has been found to be the best indicator of sludge in the heavier oils used for lubrication, since the neutralization number does not accurately indicate sludging in this type of oil.

Normally, treatment of a new batch of lubricating oil will be unnecessary before six years of operation, however, it is advisable to run an interfacial tension test about once a year during this period. Once treatment has begun, interfacial tension tests should be run twice a year to check on the condition of the alumina, and dielectric tests should be run quarterly to determine the oil's moisture content.

When first installing oil treaters, it may be necessary to recondition the oil being used. An interfacial tension test below 22 dynes per cm, or a dielectric strength of 28 kv or lower, is a signal that reconditioning may be necessary. Large amounts of sludge, scale, or lint on the strainers also indicate that the oil should be reconditioned. Mill scale may also mean that the equipment in the system, such as the storage or sump



Activated Alumina breathers used on oil storage tanks to prevent condensation.



Alumina treater for governor system oil is mounted over sump tank at Alcoa's Santeetlah Power House. Pump forces oil from sump through treater and filter.

tank, needs cleaning and reconditioning.

Reconditioning of the oil usually can be accomplished by circulating it through open-type treater tanks containing Activated Alumina, followed by a blotter filter press.

Cheoah Installation

The application of Activated Alumina treaters to the lubricating system at Aluminum Company of America's Cheoah Hydroelectric Station, on the Little Tennessee River, is an interesting example of the application of an oil maintenance program. The hydroelectric units, installed at Cheoah in 1919, were equipped with a central type, lubricating system containing 12,000 gallons of high grade, straight mineral lubricating oils. The system lubricates Kingsbury and turbine guide bearings at a maximum pressure of 21 psi, and with a maximum oil temperature of 115 F at the bearings.

By 1939, the neutralization number had risen to 0.28, and sludging was in evidence. Activated Alumina treatment was instituted, using 1800 lb of 14-18 mesh alumina in an open-type treater tank followed by a blotter press. The oil was tapped from one of the lubricating system lines and passed through the treater, blotter press, and into the sump at a rate of 200 gph. In the first three months of operation, the neutralization number dropped from 0.28 to 0.11.

Fourteen months after this treatment, an oil sample from this system was sent to the producer of the oil for analysis. The analysis indicated that the oil was in excellent condition for continued service, being only slightly changed from its condition when new.

In 1948, it was decided to equip the lubricating system at Cheoah with a permanent by-pass treater. A pressure treater holding 100 pounds of Activated Alumina was tapped into the line and equipped with a valve to allow a flow of 30 gph. A resin stabilized paper filter was placed in the oil flow following the treater, and a gage was mounted on the treater to indicate pressure drop across the filter cartridges.

Oil-Operated Control Systems

By-pass treaters containing Activated Alumina also have been successfully applied to oil-operated control systems. The treaters and the means of application are essentially the same as for lubricating systems.

At the Cheoah Powerhouse, the centralized governor system has a capacity of 2500 gallons of oil, and operates at 150 psi. Between 1919, when the system was installed, and 1936, the only maintenance required was the addition of 250 gallons of make-up oil. By 1936, however, the strainers in the system indicated a large amount of sludge, and the neutralization number had risen to 0.53. Treatment of the oils with Activated Alumina was therefore instigated.

The oil was by-passed through two, open-type treater tanks, each containing 750 pounds of alumina, at a flow rate of 200 gph. It was then passed through a blotter filter press before returning to the governor system sump tank. Over a six months period, a total of 880 hours of treatment were recorded, and the alumina required reactivation three times. This treatment lowered the neutralization number to 0.16.

By 1939, the neutralization number had risen to 0.24, so the oil was again by-passed through the open-type treater and blotter press. After a month and a half, the neutralization number had been lowered to 0.09 and the treatment was stopped. As before, 750 pounds of alumina were used. However, it did not require reactivation after this service, indicating that a lesser amount could have been used.

In 1948, it was decided to equip the Cheoah governor system with a permanent Activated Alumina by-pass treater. A 150 psi pressure line was tapped, and a valve was inserted to allow a flow of 30 gph through the treater, which contained 100 pounds of alumina. A resin stabilized paper filter was placed in the line, and a pressure gage was mounted on the treater. When the pressure drop across the cartridge increases from 10 to 40 psi, it indicates that the cartridge should be changed. Since the by-pass system has been installed, the Activated Alumina has been changed often enough to maintain an interfacial tension test reading of 18 dynes per cm.

Storage Tank Breathers

Activated Alumina also is used in breathers to prevent moisture from entering oil storage tanks. When tanks are empty, moisture will normally enter and condense, causing corrosion. Later, when oil is put into the tank, the moisture and corrosion will contaminate the oil. An alumina breather mounted on the tank can prevent this condition.

Before equipping a tank with a breather, rust should be removed from the tank by cleaning it with mineral spirits and wiping it dry with rags, followed by shot or grit blasting. When all traces of oil and rust have been removed, it should be painted with a nonrust coating.

Insulating Oils

Electrical insulating and cooling oils are another important field of application for Activated Alumina treatment. Maintenance of transformer oils is particularly important, since the quantities of oil involved are relatively large and the rate of deterioration is quite rapid.

Although the exact method of applying the alumina treatment to transformers varies with the type of unit, the recommended procedure for large units is to employ continuous treatment, using an Activated Alumina by-pass treater and an alumina breather. The oil can be circulated through the treater by a centrifugal pump, or in some types of transformers, by thermo-syphon action which utilizes the difference in the temperature of the oil in the transformer and that in the treater.

Batch treatment using open-type treater tanks is sometimes recommended, particularly for reconditioning oil which has reached a high degree of contamination. On small transformers, particularly units of less than 100 kva, it may not be practical to install by-pass treaters. The most practical method of continuous treatment for these units is to hang canvas bags or perforated metal cans of alumina in the oil inside the transformer, but out of contact with live parts.

Because of the low operating temperatures of circuit breakers, the rate of oil deterioration is much slower than in transformers. After 10 to 15 years of operation, however, the exposure to air at ambient temperatures causes the oil to deteriorate, and it has therefore been found profitable to adapt by-pass treaters to large oil circuit breakers. For smaller units, where continuous by-pass treaters are not practical, the oil can be drained and stored until there is enough for batch treatment.

The development of the pneumatic mechanism for circuit breakers has provided another application for Activated Alumina. Here, the compressed air is passed through a bed of alumina. The normal oil circuit breaker operation requires that the alumina in the dryer be changed at least every six months. The charge can be changed at scheduled intervals, or a perforated plastic or wire screen cartridge containing a special type of Activated Alumina, known as F-6, can be inserted in a well near the top of the dryer. This sample will indicate when the charge is spent by changing from a blue to a pink color.

Alumina dryers should also be used for the air compressors on air blast circuit breakers, and on air compressors supplying air to hydraulic governor oil pressure tanks.

Bushing Oil Maintenance

Moisture entering oil-filled bushings by breather action can be a serious matter, particularly if sludge is present in the oil. The resulting mixture of sludge and moisture is adsorbed in the capillary spaces of the bushing's insulating barriers, causing an increase in the power factor and decrease in the dielectric strength of the insulation, thereby increasing the danger of a failure.

Bushings having a breather vent and equipped with a glass bowl for visual indication of oil level are adaptable for the use of alumina. These units are found on certain transformers, oil circuit breakers, and metering equipment. Sacks of Activated Alumina placed in the bushings provide the most economical treatment.

Maintenance Records

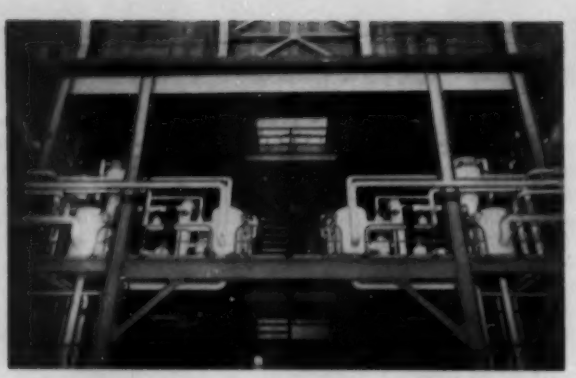
Once a plan of action for the maintenance of oils has been formulated, regardless of the type of oils involved, it can be executed successfully only if adequate records are kept. Keeping data on an oil maintenance program performs two basic functions. With up-to-date information on the condition of all oils, deviating oils can be corrected at the right time with the proper method. In addition, the plant engineer will be able to accurately measure the savings afforded by the program.

Tests on the oils should be performed at scheduled intervals, based upon operating experience. The objective should be to obtain the maximum service out of the alumina before reactivating it, but without allowing the oil to deteriorate.

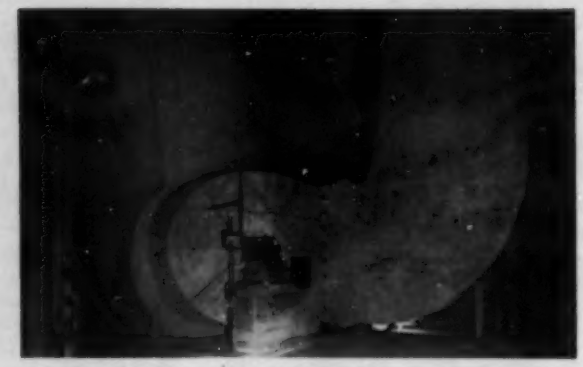
Additional information on this subject is available in a paper, "The Use of Activated Alumina in the Maintenance of Power System Oils", Aluminum Company of America.

Alumina dryer removes moisture from compressor intake air for oil circuit breaker's pneumatic mechanism.

Before installing permanent treaters, reconditioning of the oil with open type treaters may be required.



Condensate drain tanks and the piping systems between units 1 and 2 are insulated with 85-percent Magnesia.



Block insulation on the fans and ducts is applied on 6-gage, 6 x 6 wire mesh secured to the stiffening ribs.

Shawnee's Engineered Insulation

E. L. HOLTSFORD, Vice President and General Manager
Badham Insulation Company, Birmingham, Alabama

ESTIMATES INDICATE that the Shawnee station of the Tennessee Valley Authority will be one of the most costly of the seven TVA steam-electric power plants in terms of initial investment. This is because it is being installed at a time when construction costs are at peak, and because it is the only unit in the group not built on rock foundation. The station's location on the Ohio River's flood plain required special foundation work and extra braces in the steel frame of the structure, as well as 8-in. relief wells around the plant at 40-ft centers for control of the ground water. Despite these factors, a construction cost of $144 per kilowatt is being achieved.

Heat Rate

Ample justification of the capital expenditure is contained in the December 1953, interim report of the Federal Power Commission on the first of the ten 150,000-kw units at Shawnee to be completed. This report lists the initial unit as using only 9400 Btu per net kw. If similar operating economy is maintained for the entire station, Shawnee will rate among the country's first five steam power plants. In contrast, the Johnsonville TVA plant, rated eighth among 331 steam power plants, uses 10,086 Btu per net kw. However, like most TVA plants that followed Johnsonville, greater efficiency has been obtained at Shawnee through the use of reheat boilers.

Competently engineered insulation is another major factor that contributes materially to the plant's performance. Three principal considerations were given careful attention. First, all insulation thicknesses are designed to assure maximum heat conservation. Second, staggered, double layer construction is applied wherever practicable to avoid direct openings at joints resulting from expansion of piping or equipment. Third, the specifications called for application techniques designed to provide long life, minimum maintenance, maximum heat saving, and protection against mechanical, moisture, or other possible damage.

In general, all piping and equipment in the moderate temperature range is covered with single or double layer 85-percent Magnesia insulation. Higher temperature units have combination insulation consisting of diatomaceous silica material on the hot surface and an outer layer of 85-percent Magnesia. A temperature limit of 600 F was specified for 85-percent Magnesia and 1500 F for diatomaceous silica.

Pipe Insulation

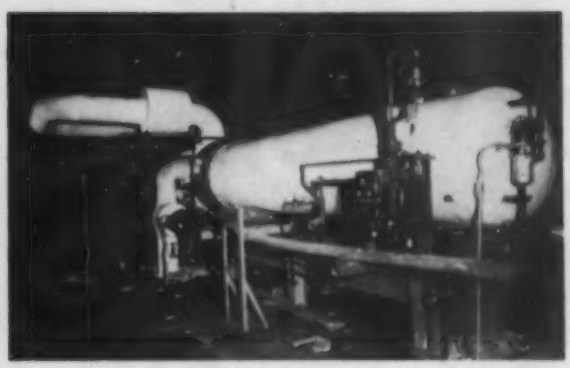
Pipe insulation thicknesses are given in Table I. Insulation on medium temperature piping is applied in one layer, except on 12-in. and larger pipe where the indicated 3-in. thickness of 85-percent Magnesia is in two layers. In double layer construction, the blocks in the second layer always are staggered with respect to those of the first layer at all circumferential and longitudinal joints. On pipes over 500 F, the first layer is diatomaceous silica and the second is 85-percent Magnesia, again with all joints staggered. Pipes up to 6-in. diameter have three loops of 16-gage annealed iron wire securing each section of insulation, while larger pipes have four wire loops per section.

Where segmental insulation is used on large pipes, and on all bends, a thin coat of asbestos cement is applied to present a smooth, even surface. Insulation on pipe over 500 F is finished with a jacket of commercial-grade asbestos cloth, and piping under 500 F with 8-oz canvas.

All pipe insulation stops short of flanges to permit ready access to bolts. At such points, flanges on the larger valves and fittings are insulated with block or sectional insulation of the same type and total thickness (including ½-in. asbestos cement finish) as the adjacent piping. This insulation extends over the adjacent pipe insulation for a distance equal to the pipe insulation thickness. Fittings on pipes less than 4-in. are covered with asbestos cement.

On vertical steam mains, the insulation is in three layers, two of high temperature material and one of 85-percent Magnesia. Supports for the first layer are affixed to the steam main on 36-in centers, while metal

The dust collector hoppers are covered with 1½-in., 85-percent Magnesia blocks and ½ in. of asbestos cement



Insulation on the high pressure heaters, which handle 1,000,000 lb of 1000 psig steam per hour, is 3-in. thick.

collars applied over the underlying insulation hold the second and third layers in place. In addition, the insulation is protected by 28-gage galvanized sheet iron jackets where lines pass through floors or walks.

Heater Insulation

Seven heaters are insulated with 85-percent Magnesia blocks, ranging in thickness from 1-½ to 3 inches, plus a ½-in. coat of asbestos cement. Heaters 1, 2, and 3 and the deaerating heater have an inner layer of 1-in. thick high temperature insulation within a radius of 2 ft of the steam inlet. This insulation is finished with an 8-oz canvas jacket. Single layer 85-percent Magnesia insulation, applied in the same manner and in thicknesses of either 1-½ or 2 in., is installed on the condensate drain tank, condensate receiver tank, flash tank, boiler blowdown tank, continuous blowdown tank, and induced draft fan.

Vessels over 5-ft diameter have angles or clips welded to the surface on no more than 36-in. centers. These clips serve as anchors for the tie wires that are carried through the joints between blocks to the wire mesh and binding wires over the insulation. Asbestos cement finish is applied over the wire mesh.

Duct Insulation

Gas ducts, boiler air ducts, furnace heating ducts, and the heating boiler breeching and stack inside the building are insulated with 1-½-in. thick 85-percent Magnesia blocks, applied over 6 x 6 mesh, 6-gage welded wire fabric fastened to the duct stiffening ribs. This insulation is covered with hex wire mesh, secured with 16-gage tie wires previously affixed to the welded wire fabric and brought through the insulation joints. Asbestos cement is applied over the outer wire mesh to a total thickness of ½ inch. Fresh air ventilating ducts have 1-in. thick 85-percent Magnesia blocks, similarly applied and finished.

Gas ducts outside of the building and the fly ash collector are insulated with 2-in. thick 85-percent Magnesia blocks, applied in the same manner and covered with an asbestos cement finish. In addition, the cement is covered with hex wire mesh, a 1/8-in. coat of asphaltic plastic weatherproofing, a layer of 15-lb perforated asbestos felt, and a final coat of 1/8-in. asphaltic plastic.

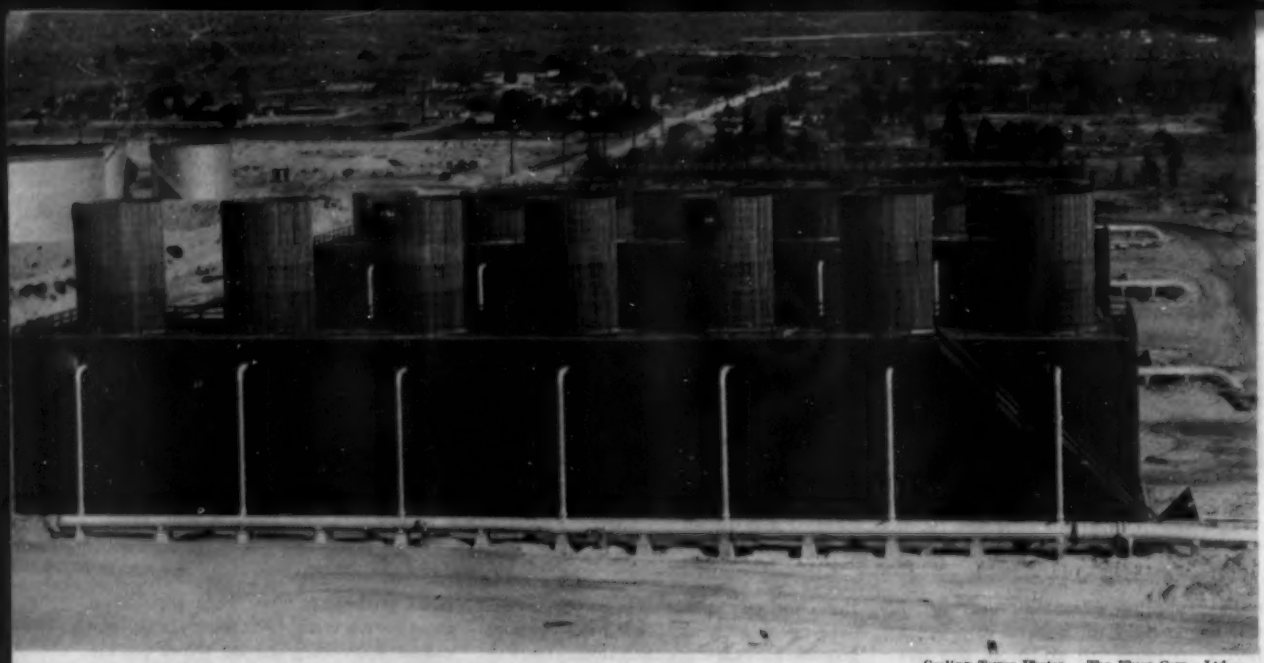
TABLE I — DETAILS OF INSULATION ON PIPING AT TVA'S SHAWNEE STEAM STATION

	Operating temperature, deg F									
	100-199	200-299	300-399	400-499	500-699		700-799		1000	
Pipe diameter in.	*Thickness of insulation, in.*									
	M*	M	M	M	ds**	M	ds	M	ds	M
1½ or less	1	1	1	1½	1	1	1	1	1½	1
2	1	1	1½	1½	1½	1½	1½	1½	2	1½
3	1	1	1½	2	1½	1½	1½	1½	2	1½
4	1	1½	1½	2	1½	1½	1½	1½	2	1½
5	1	1½	2	2	1½	1½	1½	1½	3	1½
6	1	1½	2	2½	1½	1½	1½	2	3	1½
7	1½	1½	2	2½	1½	1½	—	—	3	1½
8	1½	1½	2	2½	1½	1½	1½	2	3	1½
9	1½	—	—	2½	—	—	—	—	—	—
10	1½	2	2½	2½	1½	2	1½	2½	3	2
11	1½	2	2½	—	1½	2	1½	2½	3	2
12	1½	2	2½	3	1½	2	1½	2½	3	2
13	—	2	2½	3	1½	2	1½	2½	3	2
14	1½	2	2½	3	1½	2	1½	2½	3	2

*85 percent Magnesia

**Diatomaceous silica

Insulation in temperature ranges up to 499 F is finished with 8-oz canvas. All other insulation is finished with 2½-lb commercial grade asbestos cloth.



Cooling Tower Photos — The Fluor Corp., Ltd.

Cooling tower shown above offers internal gusset plate construction and sloping bar grid decks of California Redwood.

Cooling Water Gets the Treatment

L. W. FITZPATRICK, Chief Engineer
Department of Corrections
Jefferson City, Missouri

MOST INDUSTRIAL PLANTS utilize either open or closed type recirculating systems combined with proper treatment to conserve cooling water supplies. With the open system, continuous aeration in cooling towers, spray ponds, or air washers lowers the circulating water temperature by evaporation of part of the stream. During this process, quantities of gases, dirt, dust, and living organisms are constantly introduced, thereby increasing the scale forming and corrosive elements already present in the water supply.

The problems encountered in the treatment of cooling tower water are numerous. Too much emphasis cannot be placed on the fact that the results of research and experience in the behavior of natural waters is rarely of general application. Thus, each project requires individual evaluation because water from different sources, or even the same source at different periods, will invariably give altered results.

Corrosion

Since fundamental data on the effects and critical limits of various ions and compounds in their relation to the corrosion rate is lacking in literature, corrosion is always assumed to be a factor in cooling system operation. It may take several forms including: oxidation and pitting, dezincification of alloys, and cavitation attacks. In addition, dissimilar metals, repairs by welding, and voltaic couples resulting from scale formation, will accelerate the rate of corrosion.

Any metal in contact with water, or in the solution of an electrolyte such as a corrosive water, tends to go into solution. Cations (positively charged ions) of the metal tend to

WATER REACTIONS IN COOLING SYSTEMS

(a) $Ca(HCO_3)_2 + Heat = CaCO_3 + CO_2 + H_2O$
(b) $2FE(HCO_3)_2 + \frac{1}{2} O_2 = Fe_2O_3 + 4CO_2 + 2H_2O$
(c) $4Fe + 3O_2 = 2Fe_2O_3$
(d)* $Ca(HCO_3)_2 + H_2SO_4 = CaSO_4 + 2CO_2 + 2H_2O$

* Converting calcium bicarbonate by acid treatment

WATER COOLING EQUIPMENT EFFICIENCY IN PERCENT

Unit	Minimum	Average	Maximum
Spray ponds	30	40-50	60
Spray filled atmospheric towers	40	45-55	60
Atmospheric deck towers	50	50-60	90
Mechanical draft towers	50	55-75	93

flow through the solution and ultimately plate out on the surface of an electronegative metal. This will occur with an electrolytically neutral solution.

With two dissimilar metals immersed in the same electrolyte, ions interchange between the metals or with the electrolytic solution. The rate of corrosion is guided by the degree of electrical dissimilarity between metals in the regular electrochemical series and by the distance between poles. Other conditions, including high temperatures which accelerate the corrosion reaction due to increased ionization, gases released from solution, diffusion and turbulence, and lowering of viscosity all tend to encourage the migration of iron ions.

Oxygen, sulfides, sulfur, carbon dioxide, chlorides, and sulfates also hasten the corrosion rate. This can be a problem, especially in open circulating systems where greater emphasis is placed on quantity rather than on quality. Then solids content may vary from high to low limits as a result of pick up of oxygen, carbon dioxide, and sulfur compounds from the atmosphere.

Very hard waters that have been softened by base exchange process will introduce sodium ions, which are much more corrosive than the calcium and magnesium ions they replaced. Furthermore, many cooling waters have high chloride content, and this ion has a destructive effect on chemical protective films.

TYPICAL ANALYSIS OF SCALE DEPOSIT FROM HEAT EXCHANGER

Physical appearance: Tan powder, partly magnetic.

Chemical Analysis, percent		*Probable Combinations, percent*	
Loss at dull red heat	19.6	Loss on ignition	18.4
Phosphorous pentoxide	26.8	Magnetic iron oxide, Fe_3O_4	0.8
Silica, SiO_2	3.1	Silica, SiO_2	3.1
Ferric oxide, Fe_2O_3	15.4	Basic calcium phosphate, $Ca_{10}(PO_4)_6(OH)_2$	14.7
Magnesium oxide, MgO	8.7	Magnesium phosphate, $Mg_3(PO_4)_2 \cdot Mg(OH)_2$	17.3
Calcium oxide, CaO	13.4	Calcium carbonate, $CaCO_3$	9.3
Carbon dioxide, CO_2	4.1	Sodium oxide, Na_2O	0.7
Sodium oxide, Na_2O	0.7	Iron Phosphate, C Fe PO_4	27.5
Copper oxide, CuO	7.0	Copper oxide, CuO	7.0

Scale sample shows both scale and corrosion products, the scale components being calcium phosphate, magnesium phosphate, and calcium carbonate. The corrosion products are iron phosphate, magnetic iron oxide, and copper oxide.

Presence of magnesium phosphate indicates that at times there has been overtreatment with the phosphate. The presence of corrosion products indicates periodic low protective phosphate and low pH values.

RECIRCULATING COOLING WATER SYSTEM REQUIREMENTS FOR 10 F TEMPERATURE RISE

Makeup percent	*Number of water concentrations*	*Makeup, lb per 1000 Btu of heat loading*		
		Evaporation	*Windage & losses*	*Total*
10	10.0	1.0	0.11	1.11
20	5.0	1.0	0.25	1.25
30	3.33	1.0	0.43	1.43
40	2.5	1.0	0.67	1.67
50	2.0	1.0	1.0	2.0
60	1.67	1.0	1.5	2.5
70	1.43	1.0	2.33	3.33
80	1.25	1.0	4.0	5.0
90	1.11	1.0	9.0	10.0
100	1.00	0	100.0	100.0

Sulfide Ions

Sulfide ions, often present as hydrogen sulfide, sodium sulfide, or mercaptan, greatly accelerate corrosion. Typical sources include atmospheric or process contamination as well as bacterial decomposition of sulfates. Hydrogen sulfide has been identified in tower trough sludge and hot well deposits, even when makeup water and atmospheric conditions did not initially provide the contamination.

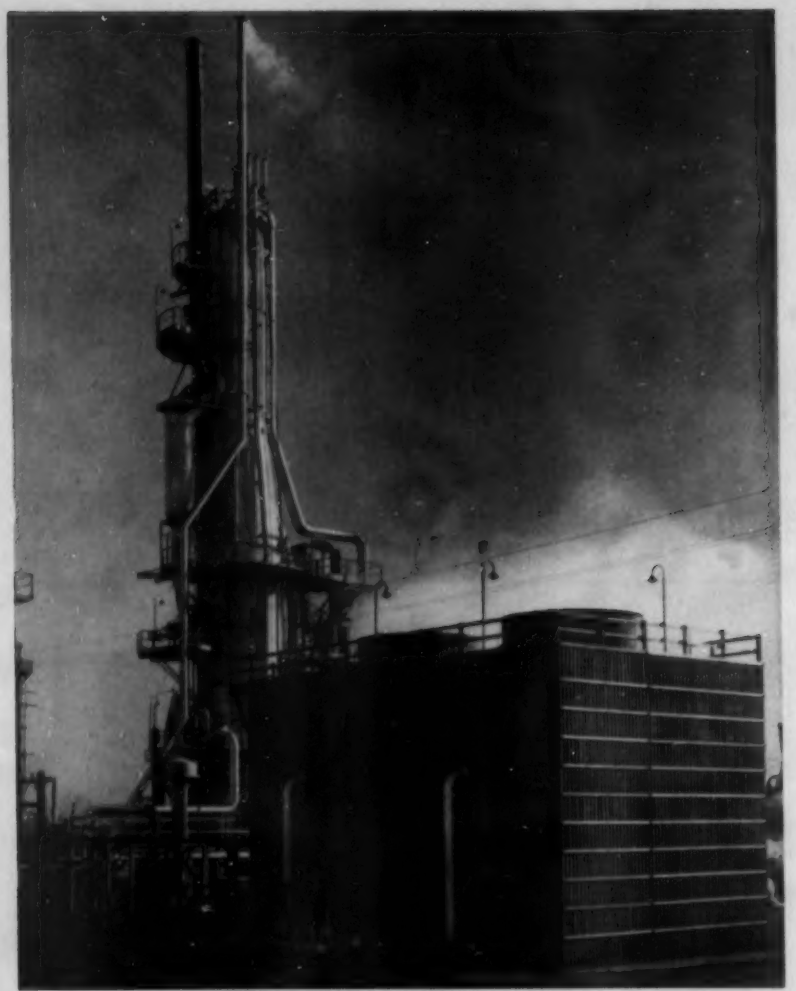
Frequently, the sulfide ion is discounted by both operators and water treatment consultants because of the time lapse between collection and analysis of the sample at a distant laboratory. Bacterial sulfate decomposition can form from minute quantities of sulfide that are not detected by routine water analysis, but which would appear in a sludge analysis. Many aerobic and anaerobic bacteria have ability to reduce sulfates, thiosulfates, and sulfites to sulfide, and in cooling systems where living organisms find a friendly habitat, sulfide is invariably common. Often immersion tests will show sulfide corrosion products even where analyses failed to indicate the presence of sulfide.

Flow Rates

Excessive water flow rates through a cooling system complicate oxygen corrosion problems although the exact effect is difficult to predict. Oxygen contact with metal surfaces is primarily dependent on water velocity, and at a certain flow rate the oxygen supply to the metal may become sufficient to form a protective film of iron oxide. However, since increased velocity always increases the flow of corrosive elements in the water, a higher flow rate might reduce or entirely eliminate the protective oxide film.

The tendency for natural or raw waters to corrode piping and metallic plant equipment has long been a problem to water chemists. Initially, an attempt was made to minimize corrosion attack by a controlled feed of an alkali, which laid down a protective calcium carbonate coating. With such treatment it was found difficult to avoid both corrosion and extensive scale formation because very narrow limits of control had to be maintained.

Most difficulties with calcium carbonate precipitation stem from the aeration and evaporation taking place during each cycle through the cooling tower or spray pond. This causes a continual loss of carbon dioxide from the water, with a shift from bicarbonate to carbonate alkalinity. With a lower water solubility, carbonates will deposit. The water temperature rise as it passes



Process equipment locations must be studied when installing cooling towers.

through a heat exchanger or condenser has little effect as the differential is purposely held within 15 F in an efficiently designed system. Maximum temperatures reached by the circulating water rarely exceed 120 F.

Scale Formation

Scale formation in cooling systems commonly revolves around the carbonates, sulfates, and silica compounds, combined with calcium, magnesium, and iron. Calcium carbonate, resulting from calcium bicarbonate naturally present in the cooling water breaking down under rising temperature, is the most common type of scale although appreciable sulfate and silica deposition can develop if skin temperatures are high. In fact, cooling system operation should be evaluated both in terms of water temperatures and the higher skin hot spots which determine the nature of the deposition.

The importance of scale control is evident from a comparison of proportionate pieces of scale and steel. Scale has just one-twentieth the heat transfer ability of steel and consequently causes a major reduction in heat exchange rates. Furthermore, high dissolved solids concentration in cooling water systems raises the effective wet bulb, thereby increasing the temperatures leaving the tower.

Scale Control

In general, scale can be controlled by softening or stabilizing treatment of the makeup. Any one or a combination of methods can be utilized, although all systems will require extremely close regulation. However, since economics enter the picture, a specialized water treatment engineer should select the design based on the plant's raw water analysis, equipment, and operation. Available methods include:

¶ Lime softening of carbonates.
¶ Hydrogen acid zeolites which will not produce sodium bicarbonate or carbonate.
¶ Sodium zeolite softening with sufficient sulfuric acid aftertreatment to convert bicarbonates to sulfates.
¶ Soluble phosphates and blended derivatives control.
¶ Sulfuric acid to change carbonates to sulfates.
¶ Chromate based treatments.
¶ Systematic blowdown schedule to control dissolved solids in circulating water at all times.

Soluble phosphate control is mainly a stabilizing action for converting any water to a compound that is neither scale depositing nor corrosive within the temperature range of the specified operating condition. Usually, polyphosphates are blended with complex derivatives of organic materials. The action is principally delaying precipitation by inhibiting crystal growth thereby preventing sludge and scale deposits. Tannins, lignins, and soluble lignin derivatives take part in the process by maintaining any precipitated material in a dispersed, nonadherent state. Polyphosphates and organic materials can be applied singly, but give superior results when used in combined form.

Average dosages for commercial stabilizing treatment range from 2 to 5 ppm, although the requirement for some waters drops as low as 0.2 ppm. On this basis, over-all treatment costs from 0.1 to 3.0¢ per 1000 gallons of makeup.

Metallic phosphates, which are fusion products of sodium phosphate and a metallic oxide, also are available for stabilizing treatment, their purpose being to introduce a metallic ion into solution without adding an undesirable negative ion. These materials have the advantages of increased solubility, greater stability, controlled toxicity, and desirable cathodic and anodic properties to aid in minimizing corrosion.

Sulfuric acid treatment is effective for some conditions. The carbonate to sulfate conversion minimizes the degree of calcium carbonate oversaturation and provides a higher concentration cycle, consequently lowering blowdown requirements. Substantial reduction of treating chemicals and makeup water is possible with this method.

Water treatment companies now offer an improved blend of chromates, phosphates, and inorganic synergists for operation in the range of 6.0 to 6.5 pH. These formulas offer an effective means for removing

or preventing both scale and corrosion under such adverse conditions as: organic, sewage, and other water supply contamination; high sulfate and chloride content; sulfate-reducing bacteria or sulfides in the water supply; presence of iron in raw makeup water; water temperatures above 130 F; and soft water makeup. During operations, a yellow or bluish color film inhibitor develops on equipment surfaces and provides an efficient barrier between the water and metal. With the low pH range in the system, calcium as $CaCO_3$ is successfully carried as high as 1000 ppm without scale formation. In addition, the chromate compounds effectively halt corrosion.

Blowdown

Systematic blowdown is required with all treatment methods because when evaporation occurs in the cooling medium, it leaves behind mineral solids which concentrate in the system. These solids must be removed by blowdown to maintain proper equilibrium of scale forming constituents, principally calcium hardness and bicarbonate alkalinity.

The best guide for control is the calcium carbonate saturation index (commonly called the Langelier index), which is a measure of the tendency for calcium carbonate to precipitate from a water under given conditions of calcium hardness, alkalinity, pH, temperature, and total dissolved solids. Basically, a positive index indicates a tendency to deposit scale, while a negative index indicates a tendency to dissolve a scale already laid down. However, the index is not a measure of capacity and will not indicate how much calcium carbonate will deposit from solution, as a high concentration of calcium and carbonate ions permits a higher deposit than a low concentration of the same ions. Also, soft waters exhibit less ability to resist changes occasioned by physical or chemical causes than a hard water under the same index.

Slime

Three organism groups; algae, bacteria, and fungi, are responsible for many troublesome conditions in recirculating water systems. Algae formations may plug nozzles and prevent proper distribution of water over the tower or collect on heat transfer equipment and decrease heat exchange rates. Slime, composed of inorganic matter bound by filamentous forms of bacterial growth, also may accumulate on water sides of heat exchangers.

Algae types include blue-green, green, and diatoms. Blue-green and green types restrict water and air flow in towers and generally flourish in parts of the system that are exposed to light and air. Many species are identified in these classes, but their over-all action and growth is practically identical. However, it is often necessary to differentiate between the types in formulating bacterial treatment.

Diatoms often are confused with mineral deposits, since they are mainly composed of silica. Different species of this type are identical in action as to forming deposits in piping and filters.

Bacteria; consisting of slime-formers, corrosive sulfate reducers, iron depositors, and other semitroublesome types, invariably form thick soft slime. The corrosive sulfate reducers change sulfur compounds to sulfides thereby accelerating corrosive attack, while the iron depositors are troublesome because they deposit slimy iron oxide in piping. The most common types of iron depositors; *Crenothrix, Callionella,* and *Leptothrix,* usually stem from well supplies. Oxidation of iron compounds gives life energy to these bacteria, and Crenothrix and Leptothrix often deposit manganese.

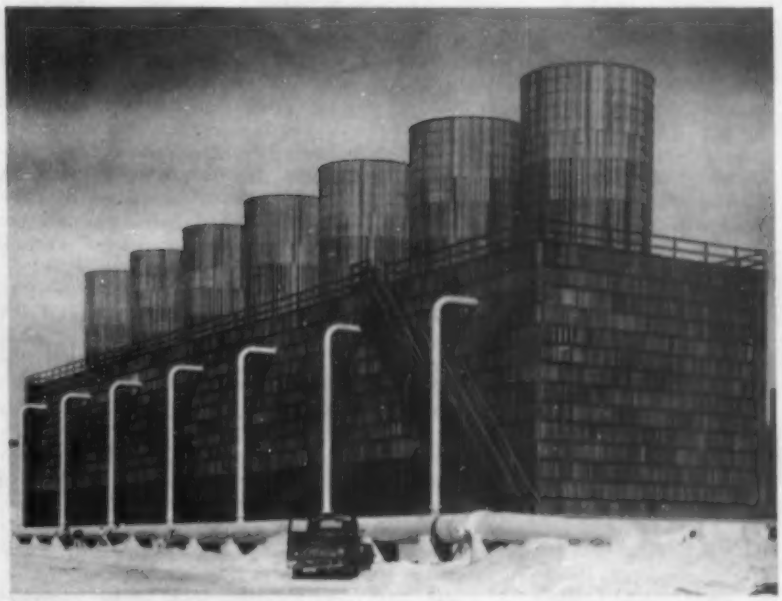
While the presence of large quantities of any bacteria shows a favorable environment, generally too much emphasis is placed on "total bacteria count." The great majority of bacteria identified in the average water sample are not important because they do not tend to clump or cause chemical reactions in a water. In actual practice, the count should be made by subtracting harmless bacteria from total bacteria.

Fungi consists of molds and yeasts and usually is found in equipment where light is excluded, mainly on heat exchanger surfaces. A single mold organism is extremely large in comparison with a yeast organism and is difficult to kill chemically. Molds exhibit a tough, rubbery surface and usually tangle with organisms of other species. Both molds and yeasts initially enter systems from air-borne sources.

Fortunately, slime-producing organisms will only cause large quantities of slime if sufficient food material from normal water and airborne dust combine with favorable temperature conditions. Many natural waters lack this food supply. Algae requires light to sustain its life, while common bacteria use a wide variety of nitrogenous and cellulose material for food.

Slime Control

Toxic chemicals provide the most efficient means of controlling slime-forming organisms, with chlorine being the sole chemical agent that completely destroys slime life. Other toxic agents poison marine organisms, but when the chemical feed is reduced or discontinued, they ultimately recover. However, many small installations do not like to handle chlorine gas, because of its corrosive and toxic qualities, and rely on other chlorine derivatives.



Cooling towers provide effective control of circulating water temperatures.

RAPID CALCULATOR FOR CALCIUM CARBONATE SATURATION

Total solids ppm	"S"	*Calcium hardness ppm of $CaCO_3$*	"H"	*M. O. alkalinity ppm as $CaCO_3$*	"A"
50 - 350	0.1	10	0.6	10	1.0
400 - 1100	0.2	12	0.7	12	1.1
		14	0.8	14	1.2
		18	0.9	18	1.3
Temperature degrees F	"T"	23	1.0	23	1.4
		28	1.1	28	1.5
32	2.6	35	1.2	36	1.6
36	2.5	44	1.3	45	1.7
44	2.4	56	1.4	56	1.8
50	2.3	70	1.5	70	1.9
58	2.2	88	1.6	88	2.0
64	2.1	111	1.7	111	2.1
72	2.0	139	1.8	140	2.2
82	1.9	175	1.9	177	2.3
90	1.8	230	2.0	230	2.4
100	1.7	280	2.1	280	2.5
112	1.6	350	2.2	360	2.6
124	1.5	440	2.3	450	2.7
134	1.4	560	2.4	560	2.8
148	1.3	700	2.5	700	2.9
162	1.2	870	2.6	880	3.0
180	1.1	1050	2.7		

Directions: 1. Obtain values of S, T, H, A.
2. Solve formula: $pHs = (9.3 + S + T) - (H + A)$
3. Saturation index is then pH — pHs.
Index = O Water is chemically balanced.
Index = + Water has scale forming tendencies.
Index = — Water has corrosive tendencies.

Continuous feed of small quantities of chlorine is the most common practice, although large once through systems often receive only intermittent treatment.

Since neither phenols nor copper sulfate will remove slime that is already formed, a complete initial cleaning is required. This can be a problem because the fact that removal of green algae from towers is not a true indication that all slime-forming organisms have been removed from the system is often overlooked. Slime formers which reduce heat transfer may be unaffected by algae removal treatment.

Making a choice as to whether the growth of organisms should be inhibited or outright destroyed will depend on the source and rate of innoculation. Any toxic chemical should be judged on the basis of its effectiveness against all organisms that are present and its ability to penetrate and disperse slime masses.

Copper sulfate, one of the oldest and most widely used toxic materials, is favorable for simple algae but is less efficient against green algae. It has one disadvantage in that with an alkaline water, the free hydroxyl ion will precipitate the copper as insoluble copper hydroxide. Even extremely dilute solutions of copper salts are corrosive to steel and iron.

Chlorine Treatment

Chlorine is the most dependable toxic agent available, and maintaining chlorine residuals as low as 0.5 ppm effectively kills organisms. Its action is nonselective, and consequently chlorine has a greater demand in high organic content waters because it reacts on dead oxidizable matter. A derivative, chloramine, provides similar results and has the added advantage of slow chlorine release. This eliminates the reaction with dead oxidizable matter.

Phenols and cresols are toxic to algae and some slime forming organisms. Both are relatively stable in alkaline waters and nonvolatile.

Potassium permanganate, while sometimes used against algae, has high oxidizing strength and is not effective in high organic content waters. Permanganate reduction products, mainly manganese dioxide, precipitate and settle in low points in the system, creating an additional sludge problem.

An algaecide should be incorporated in every water treatment program involving cooling towers and should be applied before algae is encountered. If a large algae growth has been allowed to form, careful flushing is required after initial treatment to keep the dead algae from clogging lines in the system.

Delignification

Delignification, better defined as the chemical deterioration of lumber, occurs when the lignins of wood are dissolved by cooling water chemicals. It is indicated by a soft, stringy and spongy wood structure with a decayed appearance. The condition commonly develops because the wood in the tower is alternately wet and dry, and any bicarbonates present concentrate and turn to normal carbonates.

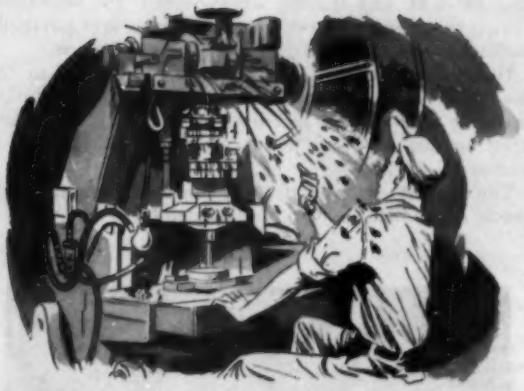
Absolutely preventing all delignification necessitates the complete removal of all bicarbonates from the system. Many plants, however, report favorable control by keeping the circulating water pH below 8.5. Modern chromate treatments, acidification, and carrying a suitable inhibitor in the system are effective solutions to this problem.

For many years, much attention has been directed at developing improved cooling tower designs, with particular emphasis on construction details which would facilitate maintenance. Records show that mist eliminator slats and supports require the most repair and replacement. Water flowing over the tower decreases the cross section and alters the structure of the wood until eventually it will support organisms that can ultimately cause destruction. Materials other than lumber, including transite and masonite wall panels and aluminum mist eliminators, have been used in recent tower installations with success.

In nominal tower operation, the inside structural framework at the lower sections is constantly wet from falling water while the top is bathed in water vapor. Frequently these wetted surfaces also are exposed to corrosive fumes from industrial processes. Under such severe conditions, maintenance and operating costs can be high.

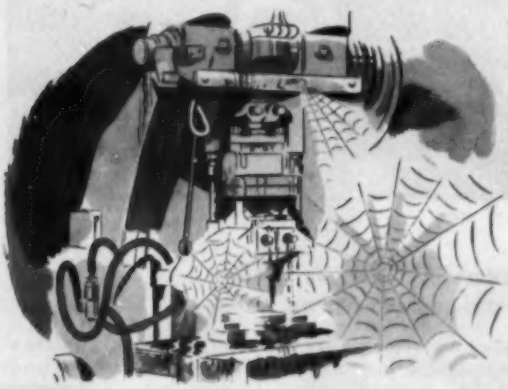
Currently, many engineers find the application of one of the available coal-tar pitch base coatings is advantageous. These coatings are impervious to water in any form, and resistant to the chemical attack of most alkaline fumes and vapors. Three coats should be applied, each being about 5 to 8 times as thick as conventional paint. This extra thickness is important since it will combat difficult corrosive conditions with a minimum of application expense.

No Downtime in Three Years After Switching to Suntac



Metalworking firm was using heavy-duty stamping presses of an older type. Bearings were wearing excessively. Oil leaked constantly—on machines, floor and operators.

Lubricant loss was so severe that bearings frequently became so hot the machines had to be shut down until the bearings cooled. This cut sharply into production.



Bearings had to be replaced on an average of once every eight months. Repairs usually took four weeks, and during this time the machines as well as the floor space were completely non-productive.

Manufacturer switched to SUNTAC because it's especially compounded to cut leakage. No breakdown now for over three years. Oil consumption reduced 50%. Also using SUNTAC to lubricate other equipment.

Do you have machines with worn, leaky bearings? Or are you losing oil through excessive throw-off from rotating or sliding parts? SUNTAC is especially compounded to reduce drip, splash and squeezeout. Its greater adhesiveness makes it cling firmly to the parts it lubricates. Get all the facts about SUNTAC from your Sun Oil representative. Or write Dept. IP-7.

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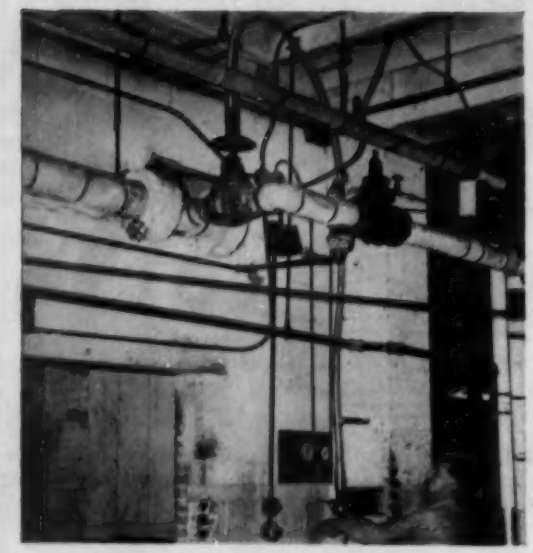


Flexible Shafting Solves Valve Control Problem

Flexible shafting, which for some time has been used for remotely controlling valves on ships, is now being used for the same purpose in industrial plants, in boiler rooms, processing plants, and in paper manufacturing.

In the illustration, a steam valve with an eight inch handwheel is being controlled by a one inch flexible shaft with a ten inch plastic handwheel at the other end. Formerly, whenever the valve was opened or closed, the operator had to climb up a ladder.

Valves as large as those with 27 in. dia handwheels can be controlled with flexible shafting which can be as long as 50 ft.

If flexible shafting is considered when piping is to be installed, it is possible to locate the pipes and the valves in places that are inaccessible to the operator and many valves can be controlled in a plant at one time from one central station.

Design manual 528, giving complete details on the remote control of valves, may be obtained by writing Stow Mfg. Co., 174 Shear St., Binghamton, N. Y.

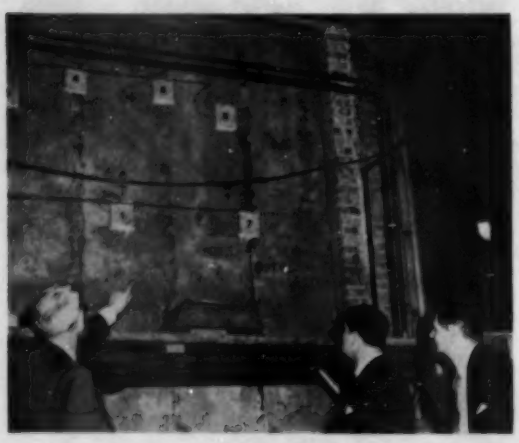
Computer Automatically Calculates Cost of Power Being Delivered

With the help of a new electronic computer, the first of its kind ever built, the power supply coordinating station at Birmingham, Alabama will be able to supervise the loading of generating stations in the complex Southern Company System. The pool system includes the Alabama, Georgia, and Gulf and Mississippi Power Companies.

Nicknamed "Early Bird," after E. D. Early, manager of the Southern Power Company pool, who conceived the idea, the computer uses actual generation values that exist at any instant as provided by telemeters. Hence the cost of power delivered from any particular station is based on actual operating conditions.

Hand operated dials, however, are provided so that the power supply coordinator can divorce the computer from the telemetering instruments to determine the desired loading schedule under any set of conditions he wishes to set up.

The instrument was designed and manufactured by Leeds and Northrup Co. of Philadelphia.



Vermiculite Concrete Walls Awarded Highest Fire Rating

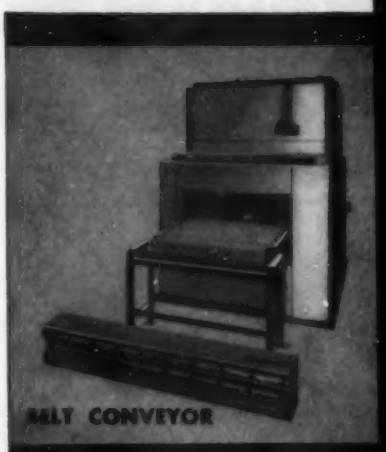
After a successful fire endurance test of five hours and 45 minutes, a four inch vermiculite concrete spandrel wall has been awarded Underwriters Laboratories' highest fire rating classification.

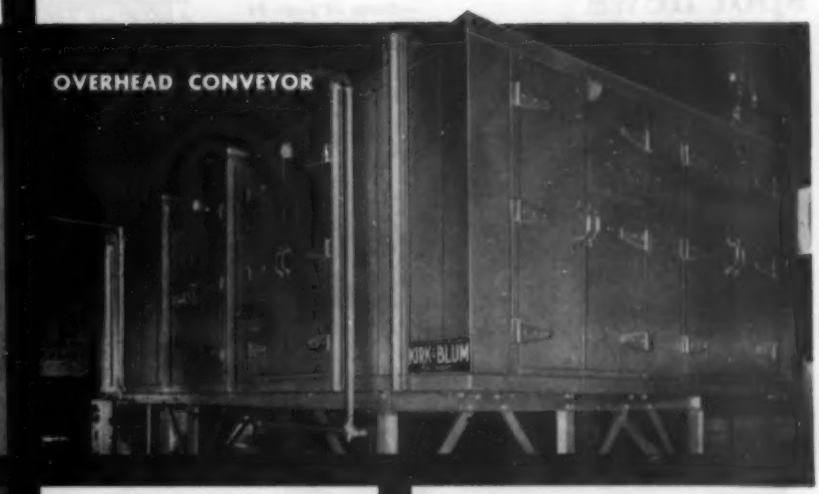
According to Edward R. Murphy, left, managing director of the Vermiculite Institute in Chicago, a regular masonry wall would have to be at least eight inches thick to achieve a comparable endurance record. Watching tests with Murphy are, left to right: Robert Parker, assistant staff architect, Ford Motor Co.; and John Dartz, engineer, New York City Board of Standards and Appeals.

The 10 x 10 ft test wall panel was framed by 2 x 2 x 3/16 in. angle irons on top and bottom connected by 1½ x 1½ x 3/16 in. channels bolted 2 ft on center. Metal clips furred out paper-backed wire lath 1½ in. from the channel face.

Vermiculite concrete, a 1:4 mix, was machine-applied to 4-in. thickness, and the resulting wall was then subjected to furnace temperatures ranging from 1700 F the first hour to 2200 F in the fifth.

The vermiculite concrete wall system is said to be suitable for fire barriers as well as for spandrel wall





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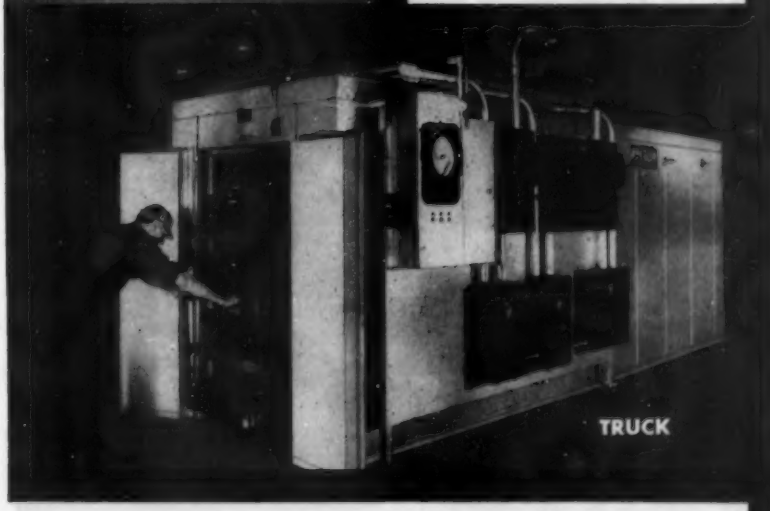

KIRK AND BLUM INDUSTRIAL OVENS

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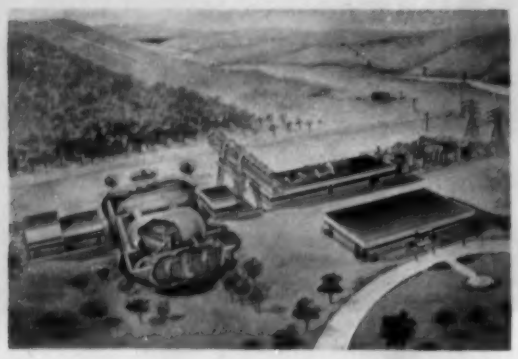
spot news

—Starts on page 84

construction. Wall in the UL tests was designed for 30 lb per sq ft wind loading.



Central Station Atomic Power Plant Expected to Produce 60,000 kw

This preliminary artist's sketch shows the nation's first central station atomic power plant which is to be built at Shippingport, Pa., near Pittsburgh, as a joint project of the U. S. Atomic Energy Commission and the Duquesne Light Co. Westinghouse Electric Corp. is developing and building the reactor portion of the plant under contract to the AEC. The Duquesne Light Co. will design and construct the turbine generator portion and will operate the entire plant.

The plant components depicted are, from the left, a building for fuel handling, the atomic reactor and heat exchangers, the maintenance building and overhead traveling crane, the turbogenerator building, the switchyard containing transformers and circuit breakers, and transmission lines. In the right foreground are shop and administrative facilities.

As can be seen from the cutaway view, the atomic reactor which provides the heat, and the heat exchangers which generate the steam, will be located underground in concrete and steel structures. These underground structures will provide protection to operating personnel and the surrounding area. In addition there are many protective devices in the reactor itself. This pioneer nuclear power plant is expected to produce a minimum of 60,000 kw of electricity.

Giant Gear Drive Unit Slated For South America

What is reported to be the largest right angle pump drive unit manufactured in the West and possibly in the nation was completed recently by Western Gear Works of Lynwood, Calif. for the Peerless Pump Div. of Food

(Continued on page 107)

Pick INSTANTANEOUS HOT WATER HEATERS

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Industries everywhere are replacing outmoded water heaters with Pick Instantaneous Water Heaters. Here are the reasons:

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★ Exact Temperature Control. Pick heaters can be operated at low or high loads with minimum temperature fluctuation. And it's done quietly.

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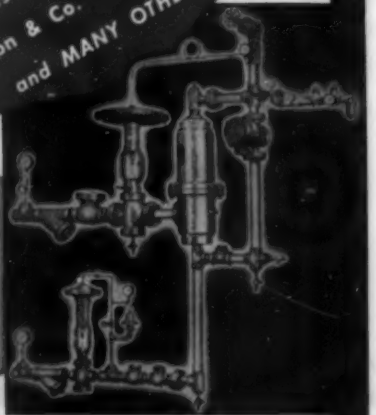

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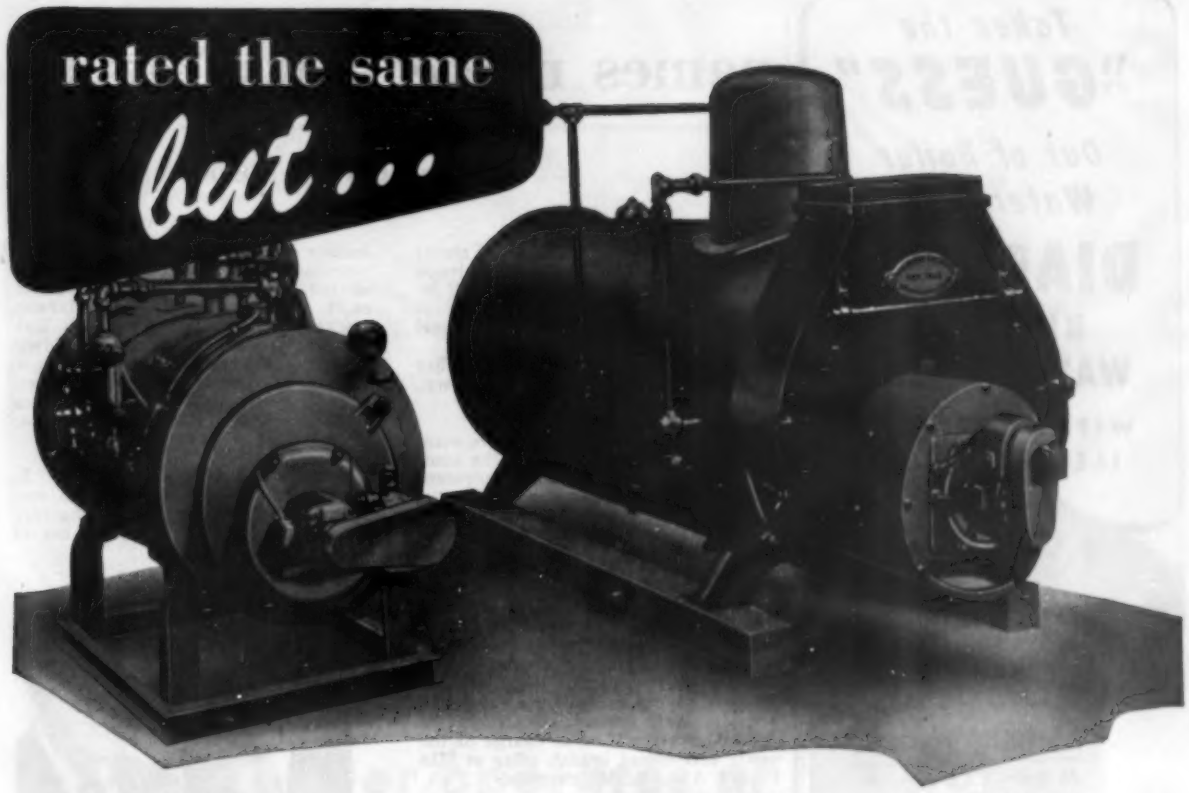

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ACTUAL MAXIMUM CAPACITY	40 HP 1380# per hr.	20 HP 690# per hr. ±

It will pay you — in the long run — to compare carefully and buy wisely.

The Leffel boiler is rated at 20 H.P.; so is the little "package-type" steam boiler. All similarity ends with that claimed rating.

The package boiler may deliver 20 H.P. — but no more. The Leffel boiler can be operated day after day at *50 percent above its rating;* in an emergency it can deliver up to 40 H.P. with safety.

Claims can't help you get steam from a boiler which is prone to break down under the strain of continuous operation — which just can't deliver beyond its rating.

There's no corner-cutting in the construction of a Leffel boiler. It's built to take it. Performance proves that Leffel's extra-rugged construction means greater dependability and longer life, plus the ability to carry a 100% overload in an emergency.

One look should tell you that the bigger, obviously stronger Leffel boiler will be a more reliable source for the steam you need. And you will find that despite their greater strength and greater capacity, Leffel boilers are competitively priced.

If you're looking for a completely dependable source for low-cost steam, trouble-free service and simple operation, you'll want to know more about Leffel boilers. They are built in a complete range of sizes from the smallest to the largest Scotch types, for oil, gas or coal firing. Bulletin 236 has all the details; send for your copy today.

FOUNDED IN 1862

THE JAMES LEFFEL & CO.

DEPT. C, SPRINGFIELD, OHIO, U. S. A.

MORE EFFICIENT STEAM GENERATION FOR 92 YEARS

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Takes the
"GUESS"
Out of Boiler Water Level
DIAMOND
BI-COLOR WATER GAUGE
with "HI-LITE" ILLUMINATOR

There can't be any doubt about boiler water level with this gauge. It depends on the different refractive indices of water and steam. Water always shows green . . . steam red. Where the two colors meet is the water line. It shows unmistakably . . . whether viewed directly or remotely with mirrors or by the "Utiliscope", (Wired Television).

"Hi-Lite" Illuminator is a greatly improved light source. It uses standard high-intensity lamps similar to automobile "sealed beam" headlights . . . retains visibility much longer between gauge cleanings. For all the facts, use coupon below.

6843

SEND TODAY

DIAMOND POWER SPECIALTY CORP.
LANCASTER, OHIO
Please send me without obligation a copy of new Bulletin No. 1051 explaining the advantages of Diamond Water Gauges and Water Columns.
NAME_____
COMPANY_____
ADDRESS_____

DIAMOND POWER SPECIALTY CORP.
LANCASTER, OHIO
Diamond Specialty Limited—Windsor, Ont.

Circle 541 on Reply Card for more data

names make news

. . . personalities from industry and power

The Babcock & Wilcox Co. Tubular Products Div. announces completion of an expansion program that will increase by nearly 40 percent their productive capacity for stainless steel tubing products.

New Cincinnati district sales office will be located at 2330 Victory Pkwy., headed by **Henry W. Doctor.**

Cleaver-Brooks Co.—Exclusive manufacturer's representative for the company's self-contained boiler equipment for northeastern Tennessee and the western counties of Virginia will be **Charles R. Carey,** Knoxville. For Montana, Lemhi County, Idaho, and northern Wyoming **Lefler Wyomont Supply Co.** will have exclusive sales and service rights on the same equipment.

Cooper-Bessemer Corp.—Thomas E. Eagan, chief metallurgist of the company has been awarded the Joseph S. Seaman gold medal by the American Foundrymen's Society.

R. B. Scott will be in charge of the newly established branch office at 5716 France Ave., S., Minneapolis.

Iron Fireman Mfg. Co.—Stanley B. Graft is appointed to the newly created post of export manager.

The Lunkenheimer Co. reviewed, during a two-day conference, new developments in the valve manufacturing field. **Harry A. Burdorf,** vice president of sales, **Melvin W. Pauly,** general manager of sales, and **Harold H. Layritz,** assistant general manager of sales directed the conference.

General Electric Co. appoints **Frederic H. Holt** general manager of the Appliance Control Dept. He succeeds **John C. Helies,** who is transferred to the Fort Wayne, Indiana office.

Fairbanks, Morse & Co.—Manager of the new pump works at Kansas City is **John R. Walsh.** His staff will include **C. Harold Johnson,** supt. of manufacturing; **Leslie G. Graper,** supt. of the foundry; **Lewis H. Kessler,** chief engineer; **Gordon L. Hanson,** works accountant; **Thomas W. Dalrymple,** production manager; **Edwin E. Cornelius,** supt. of quality control; **Clifford E. Baptist,** supt. of plant services; **Raymond G. Moen,** purchasing agent; and **Edward G. Vargon,** personnel manager.

Burgess-Manning Co.—**Ralph L. Leadbetter** is elected president to succeed **Willis L. Manning.** Manning continues as treasurer and a member of the board.

Hunter **Pahmeyer**

Combustion Engineering, Inc. announces election of two new vice presidents: **Arthur T. Hunter** and **Fred O. Pahmeyer.**

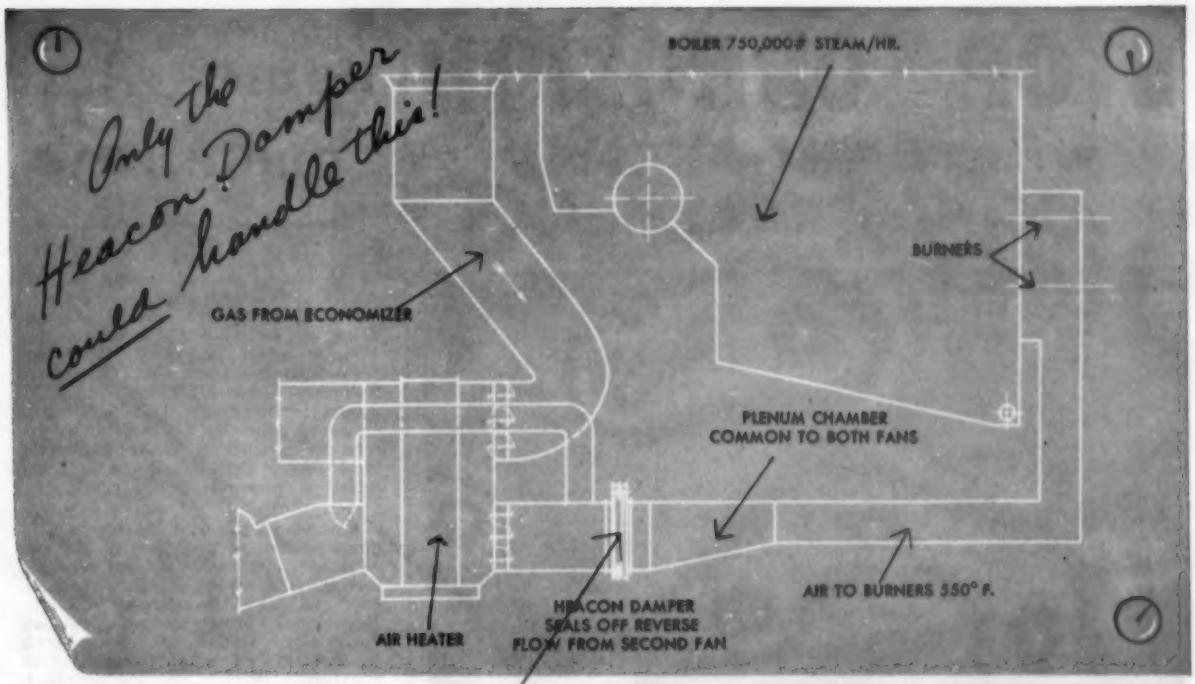
Surface Combustion Corp. appoints **Carroll Cone** as chief engineer of the Industrial Div. and **William H. Dailey** as chief engineer of the Steel Mill Div.

The Permutit Co. announces that **John S. Coppage** has joined its sales department as manager of sales, Chemical Service Div.

American Institute of Electrical Engineers has elected **A. C. Monteith,**

DIESEL ENGINE MEETING

American Locomotive Co. played host to more than 40 key oil and pipeline executives interested in stationary diesel applications at the Schenectady plant. Shown in the Diesel Engine Laboratory are, L. to R.: A. T. Lawrence, Alco; J. R. Polston, Service Pipe Line Co., Tulsa; John Thomas, Alco; and L. F. Scherer, Texas Pipe Line Co., Houston.



One of Two Air Pre-Heaters cleaned *while* Boiler operates at half load

THERMIX HEACON

There's a big difference in temperature between the inlet and outlet sides of this Heacon Damper installation when the damper is closed. There has to be because in this large western utility, air pre-heaters are cleaned while the boiler operates at half load!

This is made possible only because Heacon Dampers can effectively shut off high temperatures without leakage . . . can assure safety of personnel while boiler is in operation.

No other damper could assure the tight sealing so necessary in this installation. No other damper could provide these important benefits:

1. Quick return on investment through savings realized by operating steam generator at one-half load or better during cleaning operation.
2. Elimination of internal strains and possible damage during complete boiler shut-down.
3. Safety of personnel during cleaning operation.

Performance will prove to you as it has for others that Heacon Dampers are the most efficient dampers available anywhere. *Performance* in this installation resulted in 6 repeat orders for a total of 25 dampers!

Heacon Dampers are designed and constructed to meet practically any pressure or temperature specification. Our engineers will be glad to discuss your damper problems with you.

Project Engineers

THE THERMIX CORPORATION

GREENWICH, CONN.

(OFFICES IN 38 PRINCIPAL CITIES)

Canadian Affiliates: T. C. Chown, Ltd. 1440 St. Catherine St. W., Montreal 25, Quebec. 983 Bay St., Toronto 5, Ontario, Canada

Circle 542 on Reply Card for more data

STOP CORROSION
with BIRD-ARCHER AMINE TREATMENT

Unretouched photograph shows the ravages of corrosion on condensate return lines.

Corrosion of piping in steam and condensate return lines is an expensive two-way headache. (1) It leads to large outlays for pipe replacement and maintenance. (2) It often results in plugged return lines and traps due to the solid products of corrosion. Bird-Archer Amine Treatment effectively eliminates these troubles at low cost.

Here's how. Amines are fed into the boiler or into the steam and condensate systems. The amines raise the pH value of the condensate and also tend to inhibit equipment-destroying corrosion through surface protection of the metal itself. In scores of plants, this Bird-Archer system has more than paid for itself by substantially cutting replacement and maintenance costs.

BA-902

Bulletin CP 100 gives all the facts on Bird-Archer Amine Treatment. Write for your copy.

LABORATORIES ENGINEERS · CHEMISTS

BIRD-ARCHER
WATER TREATMENT

THE BIRD-ARCHER COMPANY, 4337 NORTH AMERICAN ST., PHILADELPHIA 40, PA.
NEW YORK • CHICAGO

IN CANADA: The Bird-Archer Co., Limited, Cobourg, Ontario
IN MEXICO: Calderas y Accesorios, S. A., Amsterdam 291, Mexico, D. F.

Circle 543 on Reply Card for more data

names make news

vp in charge of engineering and research at Westinghouse Electric Corp., as president for this year. Vice presidents will be: **G. J. Crowdes**, Simplex Wire & Cable Co.; **J. P. Newbauer**, Consolidated Edison Co.; **Claude M. Summers**, General Electric Co.; **S. M. Sharp**, Southwestern Gas & Electric Co.; and **John R. Walker**, U. S. Bureau of Reclamation. **Walter J. Barrett**, New Jersey Bell Telephone Co., was reelected treasurer for one year.

American Society of Mechanical Engineers—Elected a Fellow of the Society are: **Herman Weisberg**, mechanical engineer of Public Service Electric and Gas Co., Newark, N. J.; **Raymond P. Moore**, Niagara Mohawk Power Corp., Buffalo, N. Y.; and **Frank L. Bradley**, engineering manager of Forstmann Woolen Co., Passaic, N. J.

American Air Filter Co., Inc.—**C. A. Pickett** is elected vp of Illinois Engineering Co., a subsidiary of AAF. Pickett and **John Hellstrom** are also elected directors.

Neumann **Bauer**

De Laval Steam Turbine Co. announces appointment of **H. G. Bauer** to the new post of vice president and general sales manager. **W. A. Neumann** becomes executive vice president and treasurer.

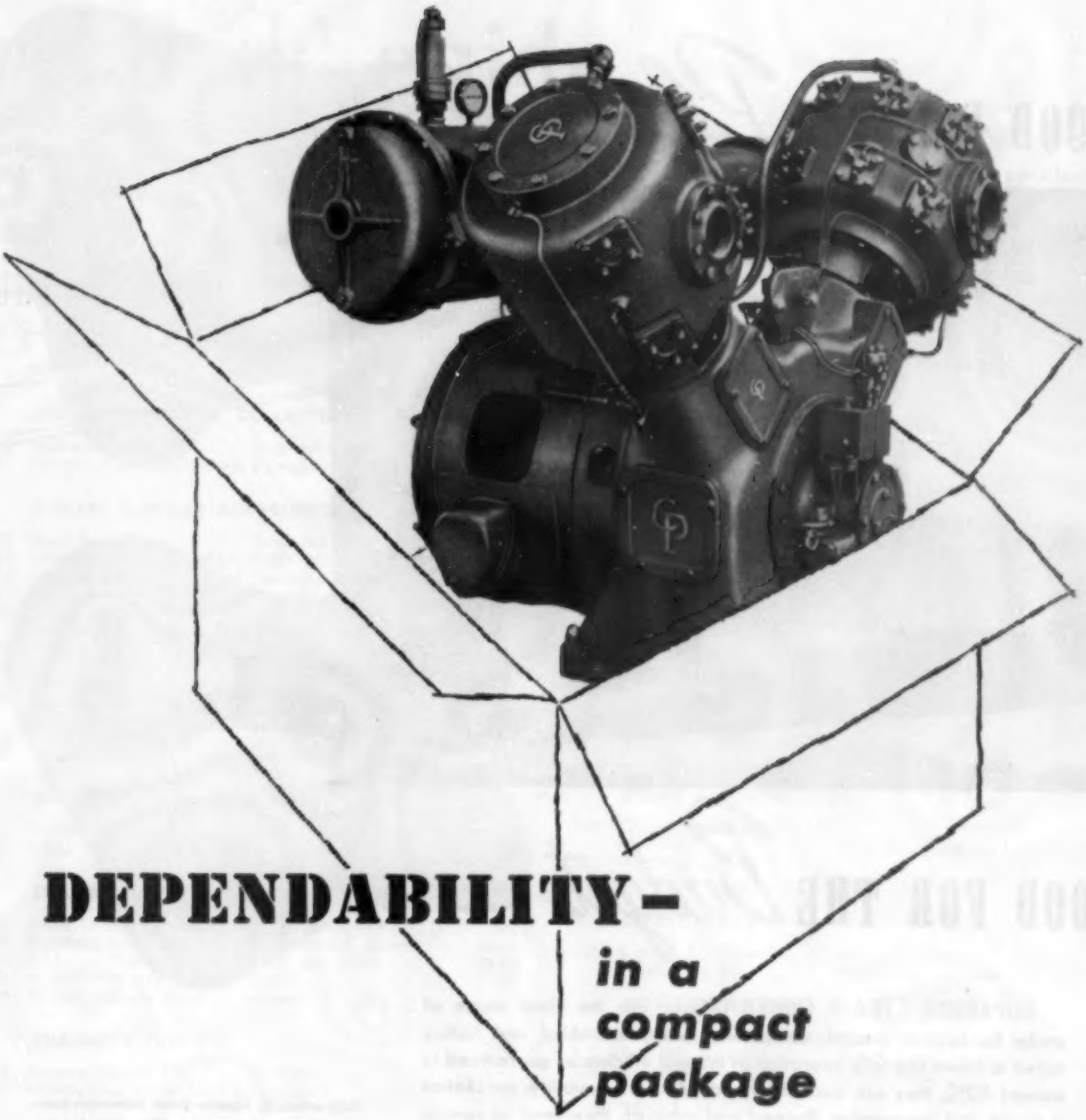
Riley Stoker Corp. announces appointment of **F. G. Treat** as vp in charge of the Detroit Plant.

The Trane Co., Little Rock Arkansas sales office will be at room 718, Pyramid Building. **Rowe Hill** is sales engineer in charge.

Worthington Corp.—**E. J. Tribble** becomes assistant vp in charge of manufacturing with headquarters at the Harrison Works; **A. M. Tullo** assumes the responsibility of works manager at Harrison; and **L. E. Hammer** takes over as Wellsville Works manager.

In the Air Conditioning and Refrigeration Div., **Donald H. McCuaig** is mgr. of application engineering.

Patrick J. Patton is appointed east central regional supervisor of the company's Positioning Equipment Div.



DEPENDABILITY—

in a compact package

With floor space at a premium, CP's space-saving Type Y Compressor is the answer! Shipped as a package ready for easy installation on a simple, inexpensive foundation, the dependable Type Y is designed for continuous operation and long life with high efficiency. Location of air inlet and discharge openings on cylinders permits the simplest and most compact piping arrangement. The "Y" arrangement also provides maximum accessibility to cylinders and to the easy-to-clean, easy-to-maintain shell-and-tube intercooler.

The Type Y has roller main bearings, precision connecting rod bearings, and multi-step capacity regulation. Available from 75 to 250 hp; 410 to 1663 c.f.m. capacity, and in single or multi-stage designs for a wide range of pressures. *Chicago Pneumatic Tool Co., 8 East 44th St., N. Y. 17, N. Y.*

Chicago Pneumatic

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

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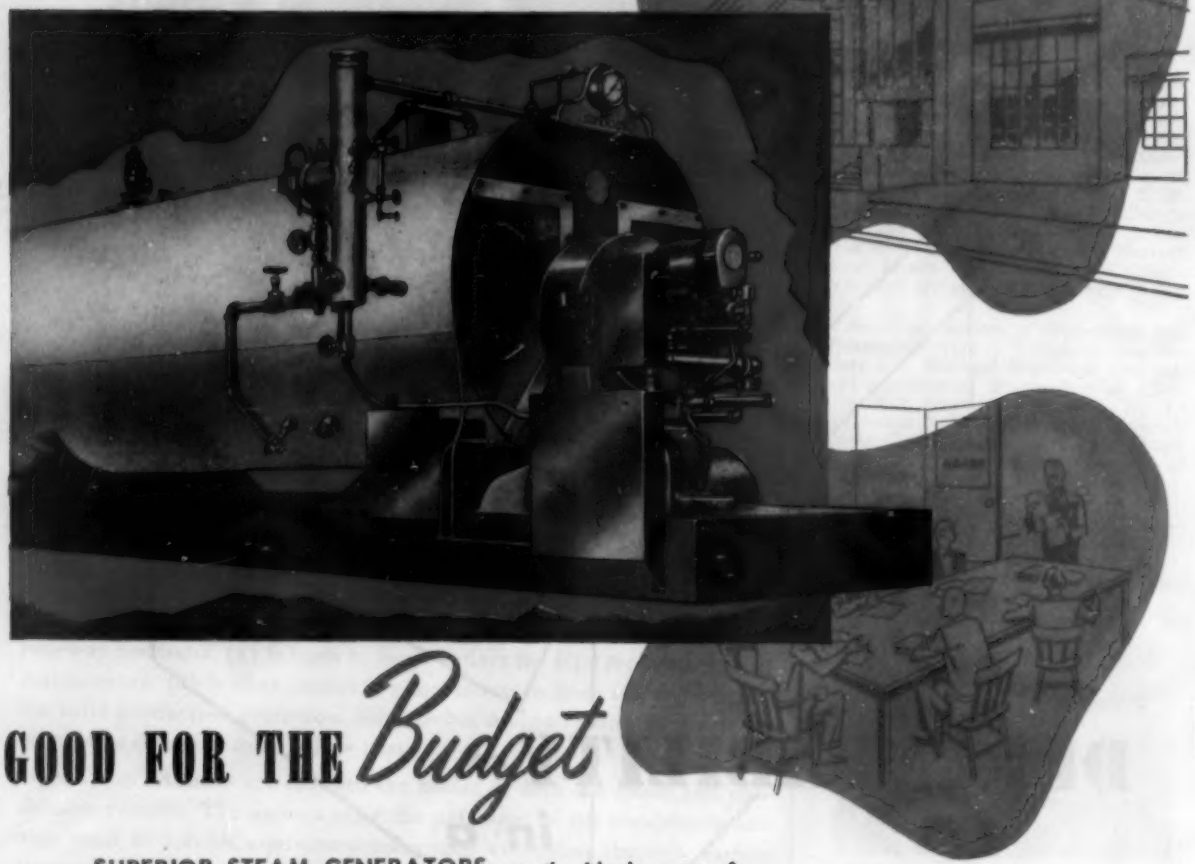
GOOD FOR THE *Plant*



GOOD FOR THE *Budget*

SUPERIOR STEAM GENERATORS are the ideal source of steam for heat or process. Completely *factory assembled*, and *factory tested* to insure capacity operation at thermal efficiencies guaranteed to exceed 80%, they are backed by undivided responsibility. Installation is simple and inexpensive. Rugged and compact, they need no special foundation, fit in limited space with low overhead.

Superior's *built-in* induced draft eliminates the need of an expensive chimney and avoids the forcing of combustion gases into the boiler room.

Superior Steam Generators reduce maintenance to a minimum and in many cases earn their total cost in less than 2 years through operating economies resulting from high efficiency.

Dependable, quiet performance, plus economies of installation and operation, make Superior the ideal steam plant.

Fully automatic, Superior Steam Generators burn gas, oil, or both. Sizes from 20 to 600 bhp. for pressures to 250 psi. or for hot water. Battery installations provide maximum flexibility for higher capacities. Write for catalog 602.

for performance you can **BANK** *on*

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

SUPERIOR
STEAM GENERATORS

Circle 545 on Reply Card for more data

readers' guide

. . . an index to advertised products

The table below lists, according to product groupings, all equipment advertised in this issue. To request more data, circle key numbers on Reply Cards, pages 36/37 & 92/93

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	AIR FILTERS & DUST COLLECTORS		
516	Northern Blower Co.	Dust collectors	28
527	Western Precipitation Corp.	Dust recovery	41
	BOILERS & BOILER ACCESSORIES		
559	Ames Iron Works	Packaged steam generator	105
514	Bituminous Coal Institute	Coals	25
533	Cleaver Brooks Co.	Packaged boilers	47
511	Detroit Stoker Co.	RotoStoker	21
541	Diamond Power Specialty Corp.	Water gages	88
542	Heacon, Inc.	Dampers	89
540	Laffel & Co., The James	Packaged boilers	87
525	Orr & Sembower, Inc.	Packaged boilers	39
545	Superior Combustion Industries Inc.	Packaged boilers	92
512	Wickes Boiler Co.	Steam generators	22-23
526	Wright-Austin Co.	Boiler accessories	40
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507	Patterson-Kelley Co., Inc.	Waste water heat reclaimer	13
539	Pick Mfg. Co.	Water heaters	86
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551	Powers Regulator Co., The	Water mixers	100
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563	Texas Co., The	Turbine oils	110
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550	United States Gasket Co.	Teflon gaskets	99
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538	Kirk & Blum Mfg. Co.	Industrial ovens	85

bulletins

. . . for listing of the bulletins just received see page 38

AIR CLEANING & DUST COLLECTION

240—Small Scale Dehydration

To meet the increased demand in engineering operations for small volumes of dry gases not warranting plant size installation, this company has developed the Hy-dryer, described in this seven-page booklet. J. F. Pritchard & Co., Equipment Div.

241—Dust Collectors and Arrestors

Series of four folders describes cyclone type collector and portable, standard, and automatic bag-type dust arrestors. Also includes 32-page catalog describing exhaust fans for dust collecting and air handling. Northern Blower Co.

242—Dust Collectors

Dust collectors, including cyclone, wet or dry dynamic, and cloth screen arrestor types are the subject of a 32-page bulletin. Uses of air conditioning, ventilating, conveying, drying, and cooling units are presented. Kirk & Blum Mfg. Co.

243—Precipitation Equipment

Engineers contemplating the installation of equipment for recovering dusts, fly ash, fumes, mists, fogs, or other similar suspensions in stack or process gases will find much valuable data in this 40 page booklet. Western Precipitation Corp.

244—Dust and Fume Removal

This 19-page bulletin, 610, pictures and describes the standard units that go to make up the Multi-Wash System for the removal of air-borne dust, fumes, vapors, and odors. Besides explaining the operation and advantages of each component of the system, the booklet includes many installation photographs. Claude B. Schneible Co.

245—Industrial Dusts

"The Collection and Recovery of Industrial Dusts," 32-page manual 101, discusses various types of dust and techniques used in analysis, lists the factors which influence choice of equipment, and explains the operation of each type of collector. Buell Engineering Co., Inc.

369—Electrical Precipitators

Booklet 2-ATC covers the history and fundamentals of electrical precipitators, design and construction, dimensions and capacities, electronic power supply, selenium power supply, and installation stories. Provides an up-to-date discussion with illustrations of latest developments. The Aerotec Corp.

370—Tubular Dust Collectors

Booklets 2-PDC and 3-PDC on mechanical dust collectors covering capacities and efficiencies, dimensions, construction and the decantation method. Latter method is used on installations where re-injection of large, unburned high carbon particles is required for economical operation. Pratt-Daniel Corp.

371—Industrial Dusts

Booklet 3-TTC gives a brief background of modern dust problems and an approach to their solution. Discussed are sources of dust, determining dust size, prediction, fly-ash emission codes, types of dust and methods of control. Diagram shows distance of dust travel from source. The Thermix Corp.

AIR CONDITIONING — HEATING & REFRIGERATION

246—Temperature, Moisture Control

Precision control of air temperature and moisture enable you to produce your product in any climate, at any season, according to six-page bulletin 122. The Type "A" air conditioner described, for drying or moistening of air, is shown in typical installation photographs. Niagara Blower Co.

247—Propeller Fans

Three new models are among the 13 types of fans shown in 40-page bulletin A-100. It also describes three types of roof ventilators, unit heaters and intake air units, and includes specifications, dimensions, and performance figures on all of the equipment plus valuable engineering data. Hartzell Propeller Fan Co.

248—Woven Electric Heaters

Pre-Fab woven electric heaters are described in folder 1548 which illustrates typical uses and gives application data for this versatile heat source. Suggested uses such as for heating gearboxes, local comfort heating, and for preventing condensation are listed along with application data. Pre-Fab Heater Co., Subsidiary of Edwin L. Wiegand Co.

BOILERS & STEAM

249—Vertical Unit Boiler

More than 25 years of development, manufacturing, and application experience are reflected in the design of the Type VU-10 vertical-unit boiler described in 16-page bulletin VU 10-8. Advantages and design features are discussed. Various possible installations are shown. Combustion Engineering, Inc.

250—Feedwater Gas Analyzer

Described in four-page folder 148BP is an analyzer for measuring dissolved oxygen and hydrogen in feedwater. Advantages, ranges, and accuracy are discussed. Cambridge Instrument Co., Inc.

251—Refuse and Wood Burning

Engineering data concerning spreader stokers installed to burn refuse or wood are contained in 24-page booklet 505. Stationary, manual dumping, power dumping, and traveling grate installations having maximum capacities from 10,000 to 275,000 lb steam per hr, steam or compressed air operated, are described. Detroit Stoker Co.

252—Boiler Controls

Specifications for the fully automatic, all electric metering type packaged control for shop assembled boilers are given in four-page folder 53-1068-239. Schematic drawing shows a typical packaged control system for a combination oil or gas fired boiler. The Hays Corp.

253—Simplified Boilers

The new line of simplified Powermaster packaged automatic boilers in sizes 15 through 100 hp, light oil or gas, are discussed in eight-page bulletin 1230. Details of design and construction, a cutaway view, and sample specifications are given. Orr & Sembower, Inc.

254—Pressure Equipment

One of the country's oldest manufacturers of equipment and accessories for plants piping steam, air, and gas under pressure, has published catalog 400, covering its line of separators, traps, and boiler trim. A condensation of the information in catalogs 500, 600, and 700, the booklet gives size and pressure tables and technical data. Wright-Austin Co.

255—Boilers

Self-contained boilers for heating and processing are described in seven-page

PRODUCT INDEX

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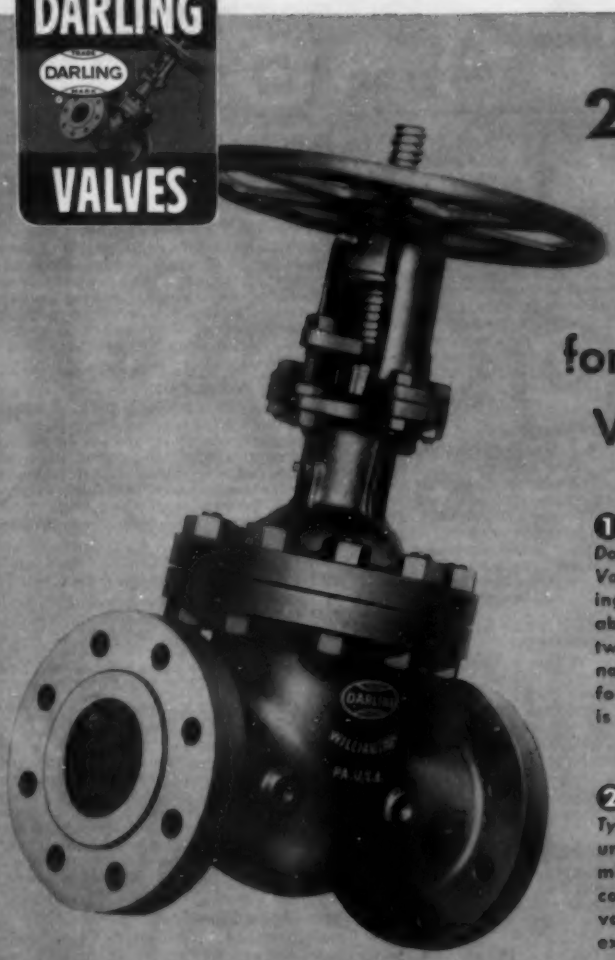
NOTE—Each bulletin item has a key number for your convenience in asking for a free, personal copy. Circle key numbers on Reply Card between pages 36/37 & 92/93.

DARLING VALVES



2 VALVE PRINCIPLES that save money for DARLING Cast Steel Valve users!

1 *Darling Fully Revolving Double Disc, Parallel Seat Gate Valve.* Just four simple working parts . . . two interchangeable, no-pocket discs and two husky wedges. Maintenance is easier, assembly is foolproof, and tight seating is assured.

2 *Darling Slotted Wedge Type Gate Valve.* Notice the unique center slot which permits wedge to seat under compression and adjust to valve seats as valve body expands and contracts.

Select the DARLING Valve to meet your specific needs

WHETHER you select the fully revolving double disc, parallel seat type . . . or the slotted double grooved wedge type . . . you'll have a Darling gate valve with outstanding features that are minimizing down time and cutting maintenance costs on job after job.

Check cutaway view No. 1. This famous Darling self-adjusting, revolving disc parallel seat gate valve is rated by users as the most trouble-free, best performing gate valve obtainable. Its simple, efficient design assures *automatic* compensation for valve body distortion. In addition, wear on valve parts is *uniform*, which means much longer service life.

Now take a close look at cutaway view No. 2. This Darling valve will do everything that an ordinary solid wedge valve can do . . . *and more.* The wedge is slotted to assure better seating under valve body expansion and contraction. Tight closure and easy operation are assured, and there is far less wear on wedge faces and seats. *Also,* the *double* grooves, with *twin* guide ribs in the valve body, provide twice the usual bearing area. Canting of wedge caused by line pressure is thus eliminated, preventing damage to the downstream seat.

You'll be wise to get all the facts about these two types of money-saving Darling cast steel gate valves before you decide on any valve. Write today for general literature, or request information on your specific valve needs.

NOTE: Darling gate valves are made in a wide range of sizes, types and constructions for all kinds of normal and unusual service . . . and for pressures up to 1500 pounds.

DARLING VALVE & MANUFACTURING CO.
Williamsport 9, Pa.

Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ontario

Circle 546 on Reply Card for more data

need information on

materials?

reach for your Plant Engineering File

"... a great time-saver"

These manufacturers' catalogs are instantly available in Sections 3a, b, d, e, f, g, h, i, of your Plant Engineering File:

Addex Corporation	Kimble Glass Company
Alan Wood Steel Company	Kiemp Metal Grating Corp.
Allegheny Ludlum Steel Corp.	Koppers Company
Aluminum Company of America	Libbey-Owens-Ford Glass Co.
American Brass Company	Ludowici-Celadon Co.
American Lumber & Treating Co.	Open Steel Flooring Institute
Anderson-Prichard Oil Corp.	Pabco Products, Inc.
Bethlehem Steel Company	Pittsburgh Coke & Chem. Co.
Bordon Metal Prods. Co.	Pittsburgh Corning Corp.
Brisk Waterproofing Co.	Plasteel Prods. Corp.
Dixon, Joseph, Crucible Co.	Plexiglas Div., Rohm & Haas Co.
Drave Corporation	Reliance Steel Prods. Co.
Drehmann Paving & Flooring Co.	Revere Copper & Brass, Inc.
Earl Paint Corp.	Ruberoid Company
Flexrock Company	Ruton, R. V., Inc.
Flintkote Company	Rust Oleum Corp.
Great Lakes Steel Corp. N-A-X Alloy Div.	Sennebora, L., Sons
Hendrick Mfg. Co.	Standard Dry Wall Prods. Co.
Insul-Mattic Corp.	Standard Steel Spring Co.
Irving Subway Grating Co.	Stonhard Co.
Jennison-Wright Corp.	Summitville Face Brick Co.
Jones & Laughlin Steel Corp.	Surface Coatings, Inc.
Kalman Floor Company	Tile-Tex Div., Flintkote Co.
Koosboy & Mattison Co.	Tnemec Co., Inc.
Korrigan Iron Works	U. S. Steel Corp.
	Uvalde Rock Asphalt Co.
	Wheeling Corrugating Co.
	Wilbur & Williams Co.

In other sections of the File you will find additional catalogs containing useful information on a wide range of products used in the maintenance of all plant facilities.

Sweet's Catalog Service

Division of
F. W. Dodge Corporation
119 West 40th Street,
New York 18, N. Y.

Circle 547 on Reply Card for more data

bulletins

—Starts on page 94

bulletin AD-100. Design is illustrated by a cross-sectional drawing and efficiency is shown by graph. Capacity and dimension tables are included. Cleaver-Brooks Co.

256—Firing Equipment

Over 50 years of leadership in the manufacture of industrial-commercial firing equipment is reflected in 19-page general catalog 3048. Schematic drawings, layouts of typical installations, cutaway views of burners and burner parts, and photographs of burners and installations are included. Petro Division.

257—Cyclonic Combustion

Principles of the patented method of Cyclonic Combustion are explained in four-page folder, "All Your Questions Are Answered by Cyclotherm." Descriptive drawings show how air is introduced into the combustion chamber at extremely high speeds in a revolving spiral vortex, radiating heat to the fire tube through direct radiation and convection. Cyclotherm Division of United States Radiator Corp.

258—Boiler Replacement

"What Every Business Man Should Know About Boilers," has been prepared to give executives a better understanding of boilers and a realization of the tremendous loss that industry is taking due to obsolete and inefficient steam generating equipment. Chances are two to one that your boiler is obsolete, according to this 14-page booklet. Superior Combustion Industries, Inc.

259—General Catalog

A wealth of research, engineering, and manufacturing experience, gained since the founding of this company in 1860, is incorporated in the products described in four-page folder. Steam generators, heat transfer equipment, pressure vessels, valves, and fittings, and refrigeration equipment are shown. Henry Vogt Machine Co.

260—Coal-Burning Installations

"Burning Bituminous Coal the Modern Way," contains 24 pages of case histories from industries of all sizes and types. Engineering survey results for equipment such as boilers, stokers, coal and ash handling units, and automatic controls, include annual fuel consumption and operating costs. Bituminous Coal Institute.

261—Boilers & Stokers

Over 88 years experience are embodied in the design and construction of Scotch Marine type portable boilers says 28-page catalog. Photographs and cross-sections illustrate various models ranging in capacities from 6 hp up to 25 hp. Details and features of underfed stokers designed especially for this type boiler are contained in separate section. The James Leffel & Co.

262—Draft Inducers

The biggest contribution to the cause of improved furnace operation in recent years has been the mechanical draft inducer, according to 12-page booklet I-52. Six causes of poor chimney draft are listed. Parts of a typical draft inducer installation are numbered and explained. L. J. Wing Mfg. Co.

263—Packaged Steam Generators

Construction of packaged steam generators is described in eight-page bulletin 1050. Auxiliary equipment is listed and a blueprint with dimensions of a typical boiler room is given. Ames Iron Works.

264—Off-Center Firing

Design features of a compact, automatic package boiler are discussed in four-page folder EC-1152. The theory of off-center firing, used with these units, is discussed. Specifications for units through 250 hp are tabulated. Dutton Boiler Div., Hapman-Dutton Co.

265—Coal Handling Equipment

Applications of coal handling equipment for the power plant, pictured in 40-page brochure 3410, illustrate the cumulative experience gained in thousands of installations over more than 75 years. Drawings show tested layouts for various operating conditions. Link-Belt Co.

266—Oil & Gas Burner

Described in 16-page bulletin ID53-162 is a factory-coordinated, industrial fuel burning system. Built around an industrial burner for oil or gas firing, the system includes proper controls mounted in panels and wired to terminal strips for easy connection, factory engineered windbox and refractory ring, fuel oil heaters, and trim. York-Shipley, Inc.

267—Two Drum Packaged Boilers

Two-drum, bent tube package boilers for steam, and high pressure, high temperature hot water are discussed in a four-page folder. Ratings, data, and dimensions are given in table form. Springfield Boiler Co., Div. of John W. Hobbs Corp.

268—Combustion Processes

Too much or too little air can have costly effects in combustion processes. Bulletin "Oxygen-Index of Combustion Processes" points out that by using oxygen itself as the criterion to proper combustion, greater over-all efficiency, and more economy can be realized. Sample point location and equipment requirements are discussed. Arnold O. Beckman, Inc.

269—Tube Cleaners

Bulletin 43 introduces a new geared tube cleaner for removing scale in heat exchanger and condenser tubes of ⅜ to 2½ in. ID. The unit is said to be particularly effective where conditions require low speed and extreme power. The Airetool Manufacturing Co.

270—Water Gages and Columns

How the Bi-Color water gage operates to show actual water level without transmission by mechanical, electrical, or hydrostatic means is explained in 23-page bulletin 1051. High-low water alarms, soot blowers, and the "Utiliscope" wired television unit are also described. Diamond Power Specialty Corp.

271—Water Tube Boilers

Packaged water tube Type H boilers, shop assembled, are described in four-page folder 3M. Capacities, dimensions, and weights are listed in tables. Drawings show various views and elevations. The Bigelow Co.

368—Tube Expanders

Rolling and flaring tube expanders and operating accessories are listed in eight-page catalog 68. Illustrations, specifications, and recommendations are included. A useful guide for ordering is also presented. The Gustav Wiedeke Co.

272—Burners

The Roto-Press burner described in seven-page booklet 9101 is designed to meet the demand for maximum steam, automatic firing, minimum floor space, and elimination of high stacks. How to convert your standard rotary burner to

a Roto-Press is explained. Combustion Equipment Div., Todd Shipyards Corp.

273—Liquid Level Indicator

Do you have to guess at your boiler water level? Nineteen-page booklet WG 1824 describes the Yarway Remote Liquid Level Indicator and shows how it is used not only for boiler water indication but for feed water and deaerating heaters, expansion tanks, hot flow softeners, and other similar uses. Yarnall-Waring Co.

274—Boiler Cleaning

Four fact-filled pamphlets explain how this company's products will help you solve algae problems, increase boiler efficiency with use of the Ever Clean boiler process, remove rust, and prevent corrosion. North American Mogul Products.

275—Boiler Service Valves

Surface blow, bottom blow-off, water column blow-off, and connections are covered in 22-page bulletin E125, with complete specifications, materials, and dimensions of each type. Valve operation is explained by illustration. Fire protection valves are included. Everlasting Valve Co.

276—Boilers and Equipment

Sixteen-page bulletin SB-50, "Erie City Boilers and Allied Equipment," describes custom designed steam generators for central station or industrial application. A number of water tube types available as well as a line of fire tube waste heat units are pictured in cross section. Erie City Iron Works.

TO REQUEST FREE BULLETINS

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372—Flue Dampers

Booklet 1-HEA on curtain type dampers for flue gas control explains what the damper is and does, construction, dimensions, installations, and gives case histories. Description and applications are treated completely. Booklet shows drawings and photos of a variety of damper types. Heacon, Inc.

277—Automatic Combustion System

How the "Thermopack" Plan meets heating and power needs of those industrial and commercial plants capable of making oil burner or oil and gas burner installations on new and existing boilers with their own maintenance crews is described in six-page foldout 185. Preferred Utilities Mfg. Corp.

278—Boiler Selection

What to look for when you select a boiler is explained in six-page foldout BE3 by means of a phantom drawing of an automatic boiler. Typical installations are pictured along with photographs of units for light oil, heavy oil, gas, and combination gas-oil. Continental Boiler Div., Boiler Engineering & Supply Co.

279—Atomizing Oil Burners

The cheapest grades of oil or tar can be completely atomized and efficiently burned with Type SA steam atomizing oil burners according to 16-page bulletin 21. Models for various special uses are described. Furnace design and construction for efficient operation is stressed. National Airoil Burner Co., Inc.

280—Boiler Baffles

"More Steam from Your Boilers," a four-page folder, explains how streamlined baffles are applied to all types and sizes of the company's boilers. Drawings indi-

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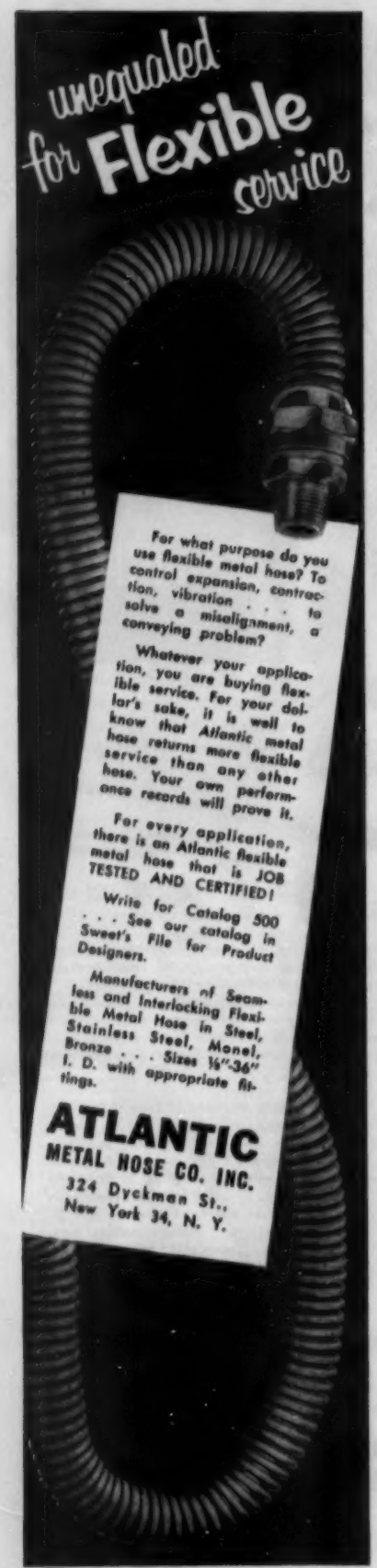
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bulletins

—Starts on page 94

cate how they are installed in each specific unit to secure crossflow of gases. The Engineer Co.

BUILDING MATERIALS & MAINTENANCE

281—Iron Cements

Suggestions for simple reliable repairs on equipment and piping using iron cement are presented in 40-page pocket-size pamphlet. Patching cement, aluminum and bronze cement, concrete paint, gaskets and clamps are also presented. Also included is a folder describing how to apply concrete paint No. 15, for interior or exterior use. Smooth-On Manufacturing Co.

282—Thread Compound

A data sheet gives complete information on C-9 "Hi-Temp" thread compound. A sample will be sent along with the data sheet. Felt Products Manufacturing Co.

283—Flooring

"Handbook of Building Maintenance," gives valuable information on keeping your plant in efficient working order. Instant-Use concrete floor patch is described with suggestions for its use, along with other materials for repairing floors. Flexrock Company.

COMPRESSORS & BLOWERS

284—Compressors

Horizontal heavy duty air and gas compressors, Type T, are described in 15-page bulletin 728-8. Cross sections of crankshaft, inlet valve unloading system, compressor cylinder and valves, and the complete compressor add to the value of the booklet. Chicago Pneumatic Tool Co.

CORROSION CONTROL

285—Rubber Linings

Application of rubber lining to prevent corrosion of tanks, pipes, and valves is discussed and pictured in four-page folder. In addition, two-page reprint tells how rubber lining can stop circulating pipe corrosion. La Favorite Rubber Manufacturing Co.

DIESEL & GAS ENGINES

286—Dual Fuel Engines

In 36-page bulletin S-500-B757 are photographic examples of each application, together with vital statistics, case histories, and comments on fuel consumption for dual fuel engines. Each feature is treated separately: the dual plunger fuel injection pump; automatic fuel switcher; automatic thermal air control; and the Micrometering gas valve. Worthington Corp.

287—Two-Cycle Diesels

Handy for filing and reference purposes, a series of data sheets gives condensed information and specifications on the full line of P & H two-cycle diesel engines. Each model or engine and power unit is pictured and discussed in a separate bulletin. All models, from 20 to 138 hp, 2, 3, 4, and 6 cylinders are included. Harnischfeger Corp., Diesel Div.

288—Air Pollution Control

How catalytic exhaust systems remove noxious carbon monoxide and irritating hydrocarbon fumes from exhausts of internal combustion engines is explained in this four-page folder. The new Dieseler exhaust which cuts smoke, odors, and CO content of 4-cycle diesel engines is also described. Oxy-Catalyst, Inc.

ELECTRICAL EQUIPMENT

289—Dry Type Transformers

How to use dry type transformers profitably in your plant is explained in folder DT 195 which also includes wiring diagrams. Acme Electric Corp.

290—Circuit Breakers

"What You Should Know About Circuit Breakers," 16-page manual 101, explains the operating principles of basic circuit breaker design. Included are simplified diagrams of three basic types. Explanations, charts and diagrams deal with temperature factors, inrush current effects, tripping and reset time. Heinemann Electric Co.

291—High Load Fuses

Hi-Cap fuses for the protection of loads above 600 amp are described in six-page bulletin HCS. Two handy charts are included: Current Limiting Effect and Opening Time Curves. Use of these fuses in conjunction with Fusetron fuses is explained. Bussmann Manufacturing Co.

292—Low Voltage Switchgear

Bulletin 6004 A is a 24-page guide to I-T-E low voltage switchgear. Illustrated with diagrams and photographs, booklet is full of information on features, switchgear components, applications, specifications, and construction data. It also describes extra services which are available to users of switchgear. I-T-E Circuit Breaker Co.

293—D-C Power Sources

D-c power sources and supplies are described in eight-page booklet B-1049. Mechanical and electrical specifications are given for the Nobratron. Sorensen and Company, Inc.

ELECTRIC UTILIZATION

294—Motors

Advantages of the various types of motors made by this company are given in four-page folder 23. Descriptions of singlephase and polyphase motors are included along with a listing of their specifications. Wagner Electric Corp.

295—Variable Speed Motors

How variable speed motors are used to improve production is described in 16-page brochure 1797. In addition to describing advantages the booklet describes design theory and construction features. Special controls, including both mechanical and electrical types, also are discussed. U. S. Electrical Motors, Inc.

296—Motor Control Center

Savings in space and expense and improved performance is explained in 12-page bulletin 170. Electrical and constructional details of these groups of combination motor starters and their components are fully described. Arrow-Hart & Hegeman Electric Co.

HEAT EXCHANGERS & WATER HEATERS

297—Heat Transfer Equipment

Various types of heat transfer equipment are among the products described in 12-page catalog 12. Also presented are various types of dry blending equipment and such process equipment as kettles, evaporators, vessels, reactors, and coils. The Patterson-Kelley Co., Inc.

298—Injection Water Heaters

Steam injection water heaters with the pressurizer piston for safe, quiet, automatic control are described in four-page pamphlet WH12A. How the unit saves space, time, fuel, installation, and maintenance costs is explained. Specifications for the seven standard sizes—for both direct and accumulator application—are given in tables. Pick Manufacturing Co.

299—Deaerating Heater

Bulletin WC-112, four pages, describes a packaged deaerating heater, spray type, for the smaller steam generating plants. Vertical two-minute and horizontal ten-minute storage units are shown in cross section. Graver Water Conditioning Co.

300—Heat Exchanger

Widespread application of the Paracoil boiler water sample cooler No. 75 gives timely importance to pamphlet 110. In addition to the design specifications, a set of charts is included to determine cooling water flow rate for various sample temperatures. Davis Engineering Corp.

301—Unit Heaters

Catalog CUH 846-A gives the complete story on Grid unit heaters. Catalog BC-1040 describes Grid blast coils for process drying. How the construction of the unit heaters prevents electrolytic corrosion is explained in booklet "Corrosion in Unit Heaters." D. J. Murray Manufacturing Co.

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302—Heat Exchangers

Bulletin 120 describes the operation of the Aero Heat Exchangers used in cooling or controlling of temperatures of industrial liquids. It shows the operation of this equipment by means of diagrams and examples of application by installation photographs. Niagara Blower Co.

INSTRUMENTS & CONTROLS

303—Flow Meters

With an alarm control, the flow meters described in this bulletin have only three moving parts. How they operate to ring a bell, light a light, or activate a motorized valve is explained by means of illustrations. Henszey Co.

304—Temperature Regulators

Bulletin 320 fully describes a simple, self-operating temperature regulator for plating, anodizing, bonderizing, pickling, cleaning and rinsing solutions. The Powers Regulator Co.

305—Flow Meters

Important data on the Diaflow Meter, for measuring air flow, gas flow, and the ratio between the two flows, are presented in eight-page booklet 52-1017-37. According to the booklet, the meter is particularly well suited for industrial furnaces and also for sewage disposal plants. The Hays Corp.

306—Gages & Thermometers

Large variety of recording, dial indicating, transformer and freezer thermometers and pressure, vacuum and compound recording gages are described and illustrated in eight-page bulletin G13C. Also four pages of operating instructions for recording gages, and complete price list. Electric Auto-Lite Co., Instrument & Gauge Div.

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MANY USES—Industrial processes; 180° F. sterilizing rinse water for dishwashers; washing oil drums, trucks, etc.

TEMPERATURE RANGE—Any temperature desired between that of incoming water and 200° F.

HAS PRESSURE EQUALIZING VALVE—which prevents delivery temperature changes caused by fluctuating pressures of steam or water.

SMALL SIZE—½" pipe size can be held in the palm of the hand, weighs 12 lbs., ¾" size weighs 23 lbs.

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bulletins

—Starts on page 94

307—Temperature Regulators

Recommended installations of temperature regulators for instantaneous water heaters, storage water heaters, and forced air heating systems are shown in three line drawings in four-page folder 1008. Spence Engineering Co., Inc.

LUBRICATION

308—Oil Filters

'Filters and Purifiers for Oil Circulating Systems,' 16-page reprint from the magazine "Lubrication" for March, 1954, discusses the contaminants encountered with oils in service and the detrimental effects associated with them. Oil oxidation and extraneous matter is listed. Selection of equipment and maintenance of the various types is fully discussed. The Texas Co.

309—Petroleum Products

Brief descriptions of the leading products this company produces for industrial use are given in folders A-2894 and A-2951. These products include hydraulic oils, metalworking coolants, heat transfer oils, and many others. Sun Oil Co.

310—Non-Fluid Oil

This constructive bulletin explains the uses and advantages of Non-Fluid Oil. According to this booklet, it cannot clog fittings, it lubricates until entirely consumed, and will not separate under pressure. A free testing sample of the oil will be sent with the literature. New York & New Jersey Lubricant Co.

311—Oil Reclaimer

Subject of four-page folder R-247 is a self-contained, compact oil reclaimer for keeping industrial oils free from contaminants. In addition to describing how the process works, the bulletin suggests applications. The Hilliard Corp.

MATERIALS HANDLING & STORAGE

312—Storage Bins

If you specify vertical storage construction for handling flowable bulk materials, this ten-page foldout will help you visualize how this company's Super-Concrete Stave Storage Bins might meet your requirements. The booklet contains photographs of typical installations, lists uses, and explains construction. The Neff & Fry Co.

METALS & WELDING

313—Steel Weldments

New close-tolerance machinery illustrated in this four-page folder makes it possible for this company to produce single components or complete assemblies to your plant's specification. Examples of equipment designed and engineered by this company are also given along with suggestions as to cast parts that can be replaced by fabricated steel weldments. The Foster Co.

314—Nickel Alloys

Helpful technical publications covering the many aspects of nickel alloys, and their applications, are listed in two bulletins. Instructions on how to order literature, free of charge, are included. The International Nickel Co., Inc.

PIPING, VALVES, & SPECIALTIES

315—Flexible Metal Hose

For what purpose do you use flexible metal hose? Whatever your application, you will find valuable information about job tested and certified hose in catalog 500. Included are data on steel, stainless steel, monel, and bronze hose in sizes 1/3 to 36 in. ID. Atlantic Metal Hose Co.

316—Flexible Couplings

Flexible couplings which never require lubrication are shown in 19-page bulletin 1009. Valuable engineering data for each type of coupling are given in table form along with drawings and application. Lovejoy Flexible Coupling Co.

317—Instrument Piping Valves

Four-page data unit 234 contains illustrations and drawings showing how this company's valves combine unions, nipples, reducers, elbows, tees, valves, and drain valves into one space-saving unit. Application information, specifications, and features are included on valves for instrument piping and general use. Jerguson Gage & Valve Co.

318—Trapping Practice

Engineers concerned with steam traps should find 48-page catalog J a valuable source of data on recommended trapping practice. In addition to explanation of how to calculate condensate loads and select traps, a maintenance section covers installation, preventive maintenance, trouble shooting, and repair. Armstrong Machine Works.

319—Pipeline Expansion

Catalog 135, 24 pages, is packed with engineering applications and selection data necessary to the proper solution of pipeline expansion problems. The center spread is devoted to a schematic piping layout illustrating expansion joint application and principles. Flexonics Corp.

320—Valve Catalog

The various types of valves made by this company are pictured by means of blue-print drawings, cross sections, and photographs in bulletins 500—505, 508, and 600. Complete dimensions are listed in tables. W. S. Rockwell Co.

321—Pilot Operated Valves

How control function of a pilot-operated valve can be changed by using a different sensitive pilot is explained in four-page folder 700. A large cutaway illustration of the valve and a detailed description of design features are included. Spence Engineering Co., Inc.

322—Reducing Valves

Four-page folder 311-A lists actual small flow reducing valve capacities based on test data. Cross-sectional drawings show construction of the bronze and steel valves. Leslie Co.

323—Regulating Valves

Bulletin 1-A, 52 pages, gives complete information on a wide range of regulating valves for steam, water, air, gas, or oil. Illustrations, cross-sectional drawings, and specifications are included. Atlas Valve Co.

324—High and Low Pressure Valves

Catalog 10 describes List 960 and 990 valves. The 960 is for a pressure range of 2000 lb at 100 F to 380 lb at 1000 F. The 990 is for higher pressures. According to the booklet, these valves offer extra protection against excessive stress with extra-strong stem and wedge-gate connection. Chapman Valve Manufacturing Co.

Torque Wrenches

Both inch-pound and foot-pound torquers are described in this complete 68-page catalog. Types included are for a wide range of drive sizes with plain or ratchet head. **Please send requests directly to Proto Tool Co., Dept. IP, 22762 Santa Fe Ave., Los Angeles 54, Calif., with 10c.**

325—Pipe Hangers

This hanger catalog describes the complete line of adjustable pipe hangers and supports made by this company. Specifications, drawings and engineering data are included. Grinnell Company, Inc.

326—Welded Floats

Units made of stainless steel, monel, and chrome plated steel, in spherical, eliptical, and cylindrical shapes are shown in eight-page bulletin 753. Sizes from 2 to 14 in. dia for pressures from vacuum to 4800 psi are listed with weights, buoyancies, and collapsing pressures. W. H. Nicholson & Co.

327—Pipeline Heating

Pipeline applications of Calrod tubular heaters in industry are shown in photographs and drawings in eight-page bulletin GEA-5095A. A comprehensive chart gives heat losses of various metals. General Electric Co.

328—Separators & Purifiers

Live steam, exhaust steam, air and gas, and receiver type separators, and steam purifiers and exhaust heads are described in 24-page catalog 500. Charts give pressure drop, steam capacity, and air capacity. Wright-Austin Co.

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329—Pipe Joint Compound

A sample of the compound will be sent with the literature on this waterproof sealer for pipe and joints carrying water or low-pressure steam. Key Company.

330—Valve Reseating

Don't junk leaky valves — reseat them. Four-page folder describes a complete tool kit that will enable maintenance men to do the job themselves, quickly and accurately. Other time-saving, money-saving, reseating tools are also illustrated. M. B. Skinner Co.

331—Chemical-Resistant Gaskets

Gaskets made of Teflon for chemical-resistant service are described in bulletin TG-933. Among the types listed are Teflon-jacketed gaskets with various types of fillers, molded Teflon Snap-on gaskets, and Teflon-jacketed adaptors. United States Gasket Co.

332—Prefabricated Conduit System

Introduced in four-page folder 5210 is a newly developed large diameter, prefabricated conduit system for protection of underground services. Prefabricated to job requirements, it contains piping for steam, condensate, water lines, fire lines, or process purposes all in place and insulated where required. The Ric-wiL Co.

333—Steam Trap

The Drainator steam trap with no moving parts is described in this illustrated bulletin. Advantages, such as the fluctuating gage glass which signals when the trap is functioning properly, are discussed. Coe Manufacturing Co.

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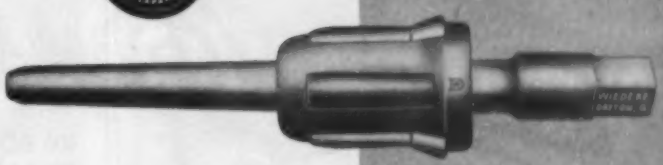

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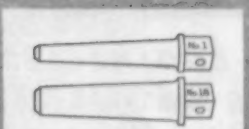

Short Mandrels

Right Angle Gear Drive

THE GUSTAV **WIEDEKE** COMPANY

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bulletins

—Starts on page 84

334—Piping Layout

How to plan an industrial waste treatment system is described in "Piping Layout No. 70." The booklet includes diagrams, specifications, and other detailed engineering data. Jenkins Brothers.

POWER TRANSMISSIONS — MECHANICAL

335—Eddy-Current Machinery

"Basic Principles of Eddy-Current Machinery," a section of 15-page bulletin GBI, explains the fundamental principles of generating torque by means of eddy-current devices. Another section, "Characteristics of Rotating Equipment," contains engineering data. Dynamatic Corp.

336—Belt Conveyor Design

Engineering data required to design a belt conveyor for any application are presented in 86-page catalog 852. The booklet, published to serve as a handbook on conveyor design, states that many problems can be answered by using a standardized unit. The Jeffrey Mfg. Co.

337—Rayon Belting

Transmission belting with rayon instead of cotton plies was proved in field applications for more than four years on jobs specially selected for their severity according to four-page folder A5163W. Uses and advantages of Thor belting are listed. Goodyear Tire & Rubber Co.

338—Holdbacks

How to protect and conserve valuable conveyor belts and safeguard operating personnel with simple inexpensive accessories is explained in four-page pamphlet 651. Photographs show operation of a roller type, instant acting holdback and of a belt cleaner. Stephens-Adamson Mfg. Co.

339—Silent Chain

One of the most comprehensive books developed on silent chain, 88-page bulletin 2425 contains detailed engineering data. Pre-engineered stock drives for normal requirements are listed. A complete section outlines selection procedure. Complete operational and technical data, such as installation, maintenance, and lubrication procedures, are described. Link-Belt Co.

340—Power Transmission

"Power Transmission Equipment," 23-page catalog 118, discusses variable speed pulleys, wide V-belts, sheaves, motor bases, countershafts, and Select-O-Speed transmission. Much more than just a catalog giving specifications, this literature presents representative applications for each unit and engineering drawings. Lovejoy Flexible Coupling Co.

341—Four-Rope Buckets

Users of overhead or bridge type cranes with four-rope bucket trolleys will be interested in 44-page bulletin 2392. In addition to discussions and illustrations of buckets, reeving and sheave bearings, the booklet also presents information on methods of selection and uses of the equipment. Blaw-Knox Co., Blaw-Knox Div.

PUMPS

342—Opposed Impeller Pump

How opposed impellers balance axial thrust is covered in 12-page brochure 1502. Sizes from 2 to 4 in., with 2 to 8 stages, are presented for capacities to 1000 gpm, pressures to 1200 psig, and temperatures to 350 F. DeLaval Steam Turbine Co.

343—Rotary Gear Pumps

"How to Solve Pumping Problems," is the title of 36-page booklet 3060. In addition to presenting typical problems and their solutions, various types of rotary gear pumps are described. The major portion of the book is intended to serve as a data handbook. Geo. D. Roper Corp.

344—Packings

Darcova pumcups, which permit equipment to be operated at reduced speeds, are described in two bulletins: No. 4502 on Pumcups for air or hydraulic mechanisms; and 4401 on units for reciprocating pumps. How these units decrease maintenance and lower operating costs is described. Darling Valve & Mfg. Co.

345—Pump Valves

Pump valves and graphite packings are delineated in 24-page brochure SC-510. Types, details of construction, design features, applications, how to order, and dimensions are included. Heaters for heating water by blending with steam are also presented. Sims Pump Valve Co., Inc.

346—Turbo Pump

Each component of the type DE turbo

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pump is pictured and its design advantages explained in a six-page folder. The lubrication system is also described in detail. Typical uses are listed. The J. S. Coffin, Jr., Co.

347—Pump Package Systems

This catalog describes pump package systems including welded steel tanks in standard sizes of 50, 100, 175, 250, and 500 gal complete with all accessories. The Manajust Stroke adjustment for varying capacity when pump is not operating, and the Autajust for precise control of flow while pump is running are explained. Orchem Pump Div.

348—Pumps

Condensed catalog "M" describes pumps for every purpose. Among those described are: turbine type pumps for use with small capacities and high heads; and type 66U side suction centrifugal pumps. Aurora Pump Co., Div. of New York Air Brake Co.

REFRACTORIES & INSULATION

349—Refractories

Charts which show at a glance the properties of refractory castables, plastics and mortars are featured in 20-page catalog R-22. Important information including recommendations for each is presented. Babcock and Wilcox Co., Refractories Div.

350—Industrial Insulation

"J-M Products for the Process Industries," eight pages, is arranged as a ready reference for men responsible for the design, installation, and operation of process equipment. It gives concise data on the properties of the various products and includes photographs showing typical installations. Johns-Manville Corp.

351—Refractories & Insulation

Catalogs R-52 through L-83, compiled in a binder, form an illustrated 40-page booklet showing where, when, and how to use various types of materials for industrial heat generation and processing equipment. An index is included for quick reference. Refractory & Insulation Corp.

352—Heat Resistant Concrete

Useful engineering data and information pertinent to the structual design of refractory and heat-resistant concrete is contained in illustrated 12-page booklet PP-5M. Subjects such as strength, volume changes, methods of reinforcing, sprung arches and domes, application to ducts, and stack linings are dealt with. Universal Atlas Cement Co., Lumnite Div.

TURBINES & STEAM ENGINES

353—Steam Turbines

Fully-illustrated 24-page bulletin 1961 emphasizes the flexibility of design of the Type-S turbine which is said to make possible selection of the proper number of stages, governor, and controls to give maximum efficiency for your steam and operating conditions. Worthington Corp.

354—Multi-Stage Turbines

Smaller framed, multi-stage turbines are featured in six-page bulletin. Overspeed governor, governor valves, blades, diaphragms, and many other design features are discussed and illustrated. The Terry Steam Turbine Co.

355—Steam Turbine Selection

Full details of this company's steam turbine are given in bulletin 135. Drawings and installation photographs point out the special features. How to save operating and maintenance costs by buying the right size for individual needs is explained. Coppus Engineering Corp.

356—Steam Turbines

If you use steam for heating, cooking, or processing, you can get power at almost no cost with the use of a Wing steam turbine according to bulletin SW-1a. Construction of these units gives an almost infinite range of speeds, easy control by throttling, and the units are independent of any electric power failure. L. J. Wing Mfg. Co.

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WASTE DISPOSAL

357—Waste Treatment

How this company has solved waste treatment problems for such industries as electro-plating, refinery, gas, and metal finishing is treated in detail in six-page booklet 70-B. Cross-sections show the various types of chemical and biological treat-

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bulletins

—Starts on page 94

ment equipment. A handy bibliography serves as a reference for more information on waste treatment in each of the industries covered. Infilco, Inc.

WATER TREATMENT

358—Water Analysis

Published by a company engaged exclusively in the solution of industrial water conditioning problems, this 14-page brochure contains brief descriptions of testing and control equipment necessary for the more common water analyses. W. H. & L. D. Betz.

359—Water Purification

"Boiler Feedwater Treatment," 19-page bulletin BFT-1, covers Inversand zeolite softeners, color process chemical softeners, and demineralizing units, including silica removal by ion-exchange. Each process is explained by means of chemical formulas and flow diagrams. Hungerford & Terry, Inc.

360—Ion Exchange Material

Strongly basic anion exchanger is presented in 16-page bulletin 57. Includes complete data on physical characteristics, exchange capacity and regeneration technique. Tables and graphs along with discussions explain performance under various conditions. National Aluminate Corp.

361—Boiler Water Foam

Laboratory pictures in this four-page folder show how Concentrol controls boiler water foam. Examples of its use in various industries are given along with an explanation of foaming. Bird-Archer Co.

362—Water Conditioning

Conditioning for general application is discussed in 20-page booklet 611A. A zeolite unit for manual and automatic operation is featured. In addition, chemical feed, zeolite-post treatment, Zeolite-alkalinity neutralization, split-stream, and anion exchange dealkalization systems are explained. Elgin-Refinite Div. of Elgin Softener Corp.

363—Ion Exchanger

"Demineralization Including Silica Removal by Ion Exchange," 28-page booklet 3603, describes applications, principles of operation, design features, and advantages, and gives recommendations and specifications for demineralizing and silica removal apparatus and synthetic resins. The Permutit Co.

364—Ion Exchangers

This 14-page booklet reviews generally the subject of ion exchange, established and potential applications. It gives advantages of the synthetic ion exchange resins and a bibliography of papers concerning their use. Rohm & Haas Co.

365—Water Softener

ZEO-FLO Sodium Zeolite Softener, a water softener specially designed for small and medium size industrial plants, laundries, and hospitals, is described in four-page folder 4505-A. How the softener has been simplified so that installation may be handled readily by the facilities of a small or medium sized plant is explained. Cochrane Corp.

366—pH Control

"Automatic pH Control in Water and Industrial Waste Treatment," eight pages, is a reissue of a paper delivered by R. T. Sheen, president of this company. Outlined are several typical systems of automatic pH control in boiler feed water treatment, using air- and motor-operated valves as well as controlled volume pumps to effect proper addition of chemicals. Milton Roy Co.

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367—Boiler Water Treatment

Difficulties caused through industrial water contamination are outlined in a 12-page catalog. Recommended water conditioning treatments for scale, sludge, corrosion, carryover and other boiler conditions, and efficient control methods are described. Details of a system of complete boiler water conditioning are fully explained. E. F. Drew & Co., Inc.

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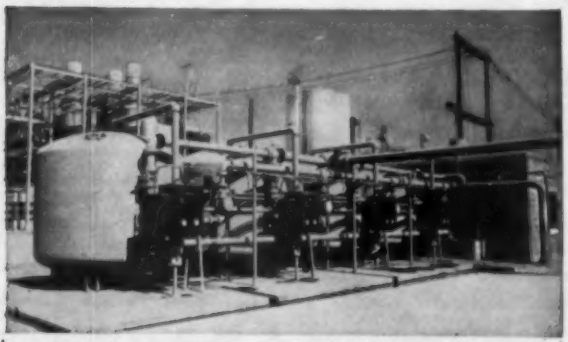
Aug. 25-27	Western Electronics Show and Convention	Los Angeles, Calif.
Sept. 8-10	American Society of Mechanical Engineers (Fall Meeting)	Hotel Schroeder Milwaukee, Wis.
Sept. 12-16	American Institute of Chemical Engineers (Fall Meeting)	Colorado Hotel Glenwood Springs, Colo.
Sept. 12-16	Illuminating Engineering Society (National Technical Conference)	Chalfonte-Haddon Hall Atlantic City, N. J.
Sept. 15-17	Compressed Air and Gas Institute Meeting	Skytop Lodge Skytop, Pa.
Sept. 15-20	Instrument Society of America (International Instrument Exposition)	Convention Hall Philadelphia, Pa.



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- "When to Use Eddy Current Couplings for Speed Control and Clutching"
- "Boiler Houses Are Not Necessary Evils"
- "Power Distribution For Large Motors No Problem at Cement Plant"

spot news

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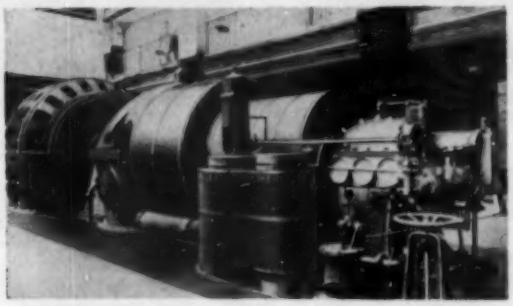
Machinery & Chemical Corp., Los Angeles.

The unit, known as Model 440-PI-400, is capable of driving a 610 hp centrifugal-type pump. A Cooper-Bessemer Diesel engine will drive the unit input shaft at 440 rpm through 4:1 gearing to turn the pump at 1760 rpm. Total down thrust on the drive is 43,000 lbs.

It will be used by the Creole Petroleum Corp., Amvay Bay, Venezuela, for pumping water at LaPlaza Venezuela, at Caracas.



Company Celebrates 50 Years In Turbine Business

Fifty Years ago Allis-Chalmers Manufacturing Co. entered the steam and hydraulic turbine business with the 5500-kw, 750-rpm, 25-cycle steam turbine unit pictured. It was installed in 1905 in Kent Ave. (Williamsburg) station of Brooklyn Transit Development Co.

By way of contrast, this year production is started on the first of two 100,000-kw, 3600-rpm steam turbines with supercharged generators for delivery in 1955 to a midwestern utility.

In addition, a complete line of single-shaft Allis-Chalmers steam turbine generator units has been carried to 200,000 kw, 3600 rpm. And recent completion of the world's first close-coupled, cross-compound unit, rated 120,000 kw, has set a practical pattern for future giant steam turbine units to 500,000 kw ratings.

In the hydraulic field, current development includes a 150,000-hp, 2500-ft head multi-jet impulse turbine, which is being built by Canadian Allis-Chalmers, Ltd. for the underground Kemano project in western Canada. Several reversible pump-turbine units are installed or in production for pumped storage development: the first for a domestic installation has just been placed in service at the U. S. Bureau of Reclamation's Flatiron plant on the Colorado-Big Thompson project.

Service Reclaims Waste Capacitor and Transformer Oils

Aceto Chemical Co., Inc. Flushing 54, N. Y. has established a service for the purchase or reclamation of certain types of waste capacitor and transformer oils, particularly those containing chlorinated materials such as are found in Aroclor or Pyranol.

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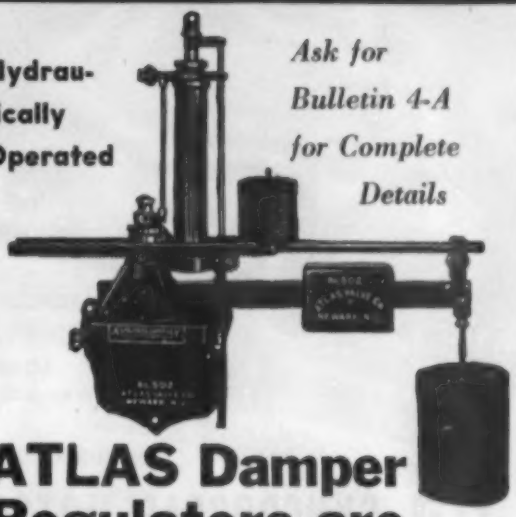

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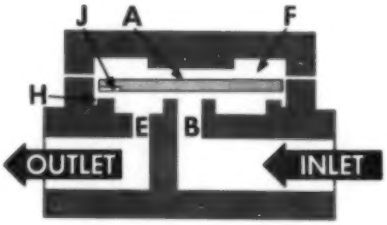
SARCO
Thermodynamic
STEAM TRAP

ACTUAL SIZE

this new trap virtually eliminates maintenance

SOLID STAINLESS STEEL DISC ACTS AS VALVE HEAD

HERE'S HOW IT WORKS!



Air and/or condensate raise valve seat disc A, discharge thru E. When steam follows, greater velocity causes it to strike body at H thus building up pressure in chamber F. This causes disc to seat, closing tube B. As pressure in F decreases by condensation and leakage thru slot J, pressure in tube B raises disc and cycle is repeated.

The Sarco Thermodynamic Trap has proved successful on steam mains and separators; headers and soot blower pipes; engine and turbine stop valves, separators and casing drains; alternate heating and cooling applications.

A solid stainless steel disc – practically indestructible – is the only moving part!

MOST striking feature of the Sarco *Thermodynamic* Trap is its simple maintenance-free design. There's only one moving part – a solid stainless steel disc that practically lasts forever. There are no other moving parts to wear out or cause trouble.

Condensate, air and steam act directly on the disc valve which opens to discharge condensate and air – snaps shut to contain steam. There are no mechanical devices required to operate valve (see diagram at left). That means practically endless trouble-free operation.

Other advantages: small size, easy installation, not affected by shock or vibration, immunity to corrosive elements with all wearing parts stainless steel, same valve head and seat for all pressures to 600 psi and temperatures to 950° F.

Check these advantages to your own satisfaction at absolutely no cost. We'll send you a trap for free trial. All you do is fill out the coupon and mail it in.

SARCO COMPANY, Inc.
Empire State Building, New York 1, N.Y.

MAIL COUPON TODAY FOR FREE TRIAL

Sarco Company, Inc., Empire State Bldg., New York 1, N.Y.
Gentlemen: Please send me a Sarco Thermodynamic Trap for free trial, requirements as checked.
Size: ½"... ¾"... 1"... Operating Pressure:.....psi

For installation on.....

NAME_____

FIRM_____

ADDRESS_____

CITY_____ STATE_____

INDUSTRY and POWER
420 Main St.
St. Joseph, Mich.
FORM 3547 REQUESTED

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